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EDITORIAL ANNOUNCEMENTS

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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CONTENTS

It is not always possible to estimate in dollars and cents the saving made by railroad improvements after the improvements have been completed, but in at least one case which has come to our attention the investment of a large sum in new repair shop facilities has proved to be highly profitable. The new McKees Rocks shops of the Pittsburg & Lake Erie have now been in operation for a little over a year and a comparison can be made of the yearly cost of making locomotive repairs with old facilities and with new and modern tools and equipment. During 1904 there was a much larger number of locomotives under repairs in the new shops than in 1903, when the old shops were in use, but the total cost of operating the shops was less than in the previous year. Had the same number of locomotives been given the repairs in 1903 that were given in 1904 it would have cost $240,000 more than the amount actually spent. This is 5 per cent. on an investment of five millions or more than three times what the new shops cost. In other words, the investment made is earning 15 per cent., and this is in addition to the great saving made by reason of better general condition of all the company's motive power and reduction of time of each engine in being laid off for repairs.

We announced briefly in our last issue that the German Government had for the first time agreed to be represented at the International Railway Congress. Americans are apt to confuse Prussia and Germany just as Englishmen constantly confuse Federal and State government in America, so it may be worth while to point out that the Imperial Government of Germany neither owns nor works railroads. It was Bismarck's original intention that the Imperial Government should purchase the railroads from the various private companies, but the particularism of the various smaller states was too strong even for Bismarck. Foiled in his first attempt he purchased the private railroads of Prussia for the Prussian Government. At present that government is probably the largest single owner of a unified railroad system in the world. The remaining railroads in the German Empire are owned by the different states; Bavaria, Saxony, and so on. Practically speaking, there are no private railroads left. As far as our information goes, no state government will send delegates. The delegates who will be at Washington will represent the German Imperial office (Reichs-eisenbahnamt), having at their head the chief of that office. They are concerned with control of administration, statistics, prevention of accidents, and the like, but have no direct charge of operation, nor are they responsible for fixing rates and classification; all that is in the hands of the several states which work the railroads.

NEW ENGLAND RAILROAD SITUATIONS.

Geographically as well as industrially the situation of New England and, we may add, the situation of its railroads in reference to other systems of the country, has been such as to give an exceptional interest to the outworking of railroad problems. And, if we demarcate from the six New England states the upper half of Maine, as a wild region not bearing closely on railroad questions, we obtain a territorial restriction which tends to focus the problems. We then find an area of about 47,000 square miles, or nearly the same as the state of New York, with 93 cities, a population of about 5,600,000, and about 13,000 miles of railroad single trackage; high industrial development outside of agriculture and very large earnings per track mile; water traffic on an extended coast line at once competing with and reinforcing railroad business; and the whole region, in an important sense, a vast terminal for a very large fraction of the general railroad traffic of the country. In this exceptional region, where railroad intensity has been in reverse ratio to area, some important evolutions have begun to hasten toward results.

Practically, and ignoring a few minor lines, New England, like old Gaul, has, in railroad meanings, divided itself into three parts. There has been the upper monopoly, the Boston & Maine, the lower monopoly, the New Haven system—both operating concordantly under the "Partition of Poland" agreement of 1893—and the Boston & Albany as a dividing line. The latter has been described as a mere outlet to the coast of the New York Central. It has been, in fact, a good deal more than that, and not only a competitor of the two monopolies at some important local points, but also at Boston; and that President Mellen was willing to trade for it the control of the Ontario & Western was an index of his estimate of its competitive power. The main point is, however, that up to comparatively a few years ago the New Haven and the Boston & Maine rested fairly content with their territorial monopolies. The former, especially, although its freight business had been long neglected, did not, until near the close of the Clark administration, feel called upon to make any bid for freight to competitive points; and the freight to non-competitive points it, of course, already had. Neither of the two large roads had then begun to feel the stress of new railroad conditions.

But those inevitable conditions came. The transfer of the Boston & Albany to the New York Central was one. Local trolley competition was another. A third, and a force of major importance, was the public demand for increased conveniences and for costly improvements returning small or remote profits on new capital expended; and a fourth was the danger feared and, perhaps, actual, that the great trunk line companies, acting in combination, would cut down percentages to New England connecting roads on rates for freight. As a result of all these forces during the last few years, and particularly during the last two, an impressive change in the New England railroad situation has ensued. The two old-time monopolies have been driven out of their isolation. They have adopted new and more aggressive plans for securing through freight. The Boston & Maine has taken the Fitchburg,

the New Haven, the Ontario & Western. President Cassatt has entered the New Haven directorate with his corporation purchaser of 10,000 shares of New Haven stock; and reports that the New York Central is looking toward an interest in the Boston & Maine may not be far before the fact. New England, in other words, under the compulsion of recognized laws and tendencies in railroad development, is no longer secluded, but a part of a greater railroad situation. The ultimate of its acuter relations with great outside interests only time can disclose.

In another direction a suggestive situation is also to be seen. The Boston & Maine, partly under compulsion of state policy and law, has not adopted any real electric policy and has bought, if we remember aright, only two or three minor street railways and those outside of Massachusetts; the Boston & Albany, notwithstanding the electric ventures outside of New England of its owner, has bought no electric railways at all. But *per contra*, President Mellen, after having well-nigh completed electric conquest in Connecticut, is rapidly pushing his invasion of Massachusetts soil on which several electric lines have already been acquired by him—through his device of a great "holding" street railway company—and bids made for others. One of the great railroad interests of New England thus is assertive, the other two, in the actual results thus far, are passive—and the Boston & Albany in its attitude repeats its old historic conservatism in the acquisition of steam roads. The two "non-electric" interests of central and upper New England may not continue quiescent, but they probably will, for some years at least, and we shall have the student's privilege of watching on homogeneous territory, under vivid conditions of contrast and, so to speak, on the same screen, the results of the two divergent policies. The situation is not made less interesting by the fact that long distance electric roads have begun to enter it and the old-time policy of Massachusetts of keeping steam and electric roads apart begins to retreat before the march of events. In this analysis of a situation we do not overlook the fact that President Tuttle, of the Boston & Maine, is now seeking for his corporation the power to acquire street railways; but his effort is belated and, even if ultimately successful, will not affect seriously the contrasts of policy which we have outlined.

Not so suggestive as the situations we have set forth, but of noteworthy interest, are two or three other phases of New England railroading. There is the four days' car detention law, costing the roads possibly two million dollars annually—a Connecticut statute, but, in President Mellen's recent words, "forcing the railroad situation and carried all the way to Portland, in fact, all over New England." There is the growing difficulty of securing positive legislation in New England favorable to the roads, partly as a result of the fact that "ideas," some right, others wrong, have been forced on New England's law-making mind by the higher pressure of railroad and railway affairs. Finally, we have the striking exhibit of a single railroad commission in Massachusetts battling hard with a set of varied problems, notably those of capitalization, while every other commission in New England is content to stand and gaze. These last situations are mainly local, but they have their examples and precept for the wider railroad fields; and beyond is the prime fact that into that greater field the railroads of New England have not only entered but are advancing.

THE INTERNATIONAL RAILWAY CONGRESS.

The opening of the International Railway Congress at Washington next week will bring together a remarkable body of railroad men from all parts of this country and of Europe and will afford opportunity for an interchange of ideas between able representatives of every department. The present session is the seventh which has been held since the Congress was organized, and the recognition given by the government in granting an appropriation, and in placing the Vice-President on the list of delegates as host, emphasizes the dignified character of the proceedings. The previous congresses, in Brussels, Milan, Paris, St. Petersburg and London, have had this same semi-official aspect, with the sessions at the capital of the country visited, and with participation in the exercises by high representatives of the government.

But it must be frankly admitted that a great congress has certain inherent limitations, as a means of extending and developing the best railroad practice. The very thoroughness with which the reports, constituting the *agenda* of the congress, have been prepared, makes it almost out of the question for a delegate to keep them all in hand. It is manifestly impossible for a busy man to get through as much literature as the permanent commission of the Congress has produced during the last year, so that it is doubtful if the bulk of the work done will bear results at all proportionate to the labor expended. The natural desire to have the reports prepared by officers noted in their own fields, rather than by men trained to write and to handle statistics, has also borne some odd results. The method of securing the basic information contained in the reports has been to send out circulars containing, in some cases, more than one hundred printed questions. The reporter unaccustomed to statistical work of this sort has frequently formulated misleading questions, evidently not understood by the railroad officer who attempted to answer them, and has made the common mistake of accepting the replies without critical examination.

Another limitation on the usefulness of the Congress is the fact that practice differs so widely from country to country that there is a comparatively small range of topics for which American managers, at least, turn to outside countries for information. We follow electrification of steam lines in England, and we ought to follow it also in Italy. We have been much interested in certain recent developments in French locomotive practice. We admire, or we ought to admire, the way the German roads handle passenger traffic; but it is probably true that the American railroad visitors to the Congress will carry away from it few, if any, new ideas received from foreign countries suitable for immediate application on their own lines.

These constitutional defects of the International Railway Congress have been frankly enumerated. On the other hand, it is always helpful for a body of highly trained men with common interests, working in widely different fields, to get together, and the investigations which have been made, even though not directly applicable to our practice, may well suggest similar investigations at home, on strictly practical lines. Much of the value of such a gathering lies in suggestion and inspiration.

While the Congress is in session the *Railroad Gazette* will endeavor to do two things. First, to present to the visiting delegates and to American readers as well a series of papers designed to round-up, in condensed form, the important topics of the day; second, to print as editorials the really valuable suggestions to the American railroad man which are brought out in Congress discussions. The reason for undertaking the first of these tasks was the evident fact that the bulkiness of the official reports would prevent the delegate from reading them. The papers in the *Railroad Gazette* have been strictly limited to approximately 4,000 words, as it was thought more important to present a clear and lucid exposition of the situation than to elaborate details. In the three special issues of May 5, 12 and 19 it is our aim to print 24 of these papers, written by men thoroughly conversant with their topic and unhandicapped by the rather unworkable system of securing data used by the official reporters. These papers and their authors will be as follows:

The Heavy Freight Train in American Railroad Practice, by George R. Henderson.

Steel Rails, by William R. Webster.

Tie and Timber Treatment, by Hermann von Schrenk.

Four-Cylinder Compound Locomotives in America, by F. J. Cole.

The Development of the Electric Drive in Railroad Shops, by C. A. Seley.

The Development of Railroad Shop Practice in the United States, by M. K. Barnum.

Automatic Car Couplers, by George Groobey.

Pooling Locomotives, by A. M. Waitt.

Cast Iron Car Wheels, by J. E. Muhlfeld.

The Development of Water Purification in the United States, by C. Herschel Koyl.

The Development in Railroad Bridge Design and Construction, by Henry W. Hodge.

The Electrification of Trunk Lines, by L. R. Pomeroy.

American Brake Shoe Practice, by F. W. Sargent.

Car Lighting, Heating and Ventilation, by George L. Fowler.

High Capacity Cars, by Rodney Hitt.

Dining Cars; paper prepared under supervision of Arthur Hale.

Coaling Locomotives, by Charles H. Fry.

Oil Fuel for Locomotives, by Howard Stillman.

The Relation of American Railroads to the Government, by Prof. H. R. Meyer.

American Roundhouses and Their Operation, by W. E. Dunham.

Competition of Electric Railways, by Ray Morris.

Progress of American Railroads in the Last Quarter Century, by Samuel Whinery.

Signaling, by B. B. Adams.

Progress in Yard Design, by W. D. Cushing.

These papers, which cover almost the entire work of the Congress in their scope, will be printed in French and English, in parallel columns, in order that they may be perfectly accessible to foreign visitors who can-

not read English fluently; and it is believed that they will constitute an important addition to practical railroad literature and will have a still further historical value as full, critical statements of American practice in many co-ordinate branches, viewed at the same moment.

The reviews of valuable parts of the discussions that take place in the Congress from day to day will be printed in the editorial columns and will likewise be translated into French. Judging from the working of previous sessions of the International Railway Congress it is improbable that very much of practical use will be developed during the progress of the meetings, owing to the difficulty, previously referred to, of getting the practice of widely different countries on a common basis, but any noteworthy points brought out will be carefully edited and presented.

A GOOD UNDERSTANDING WITH YOUR EMPLOYEES.

On the relations between "master and servant" (as the old law books have it), or between "capital and labor" (according to our degenerate modern literary standards), there is nothing new to be said. To many, the subject has become tiresome, and the reader who has read this article even this far has, very likely, done so wholly out of respect for the editor—and not because of any expectation of learning new facts or seeing new light. Still, our problem continues a live one, and its solution presses. Now and then the labor question seems to be clarified—in spots; but whatever advances toward permanent peace have been made by adopting changed methods, seem to have been largely neutralized by an increased disposition to disregard all methods; to deprecate public discussion and remain on the defensive. No failure of new methods, however, will cover up palpable disregard of well-tested old ones; and as we believe that most of the serious ruptures between railroad managers and their subordinates are caused by ignoring well-known and fundamental principles affecting the relation of employer and employee, we make no apology for repeating some well-known and possibly time-worn doctrines recently enunciated by Mr. Vreeland. We reprint them in another column.

We do not forget that Mr. Vreeland is comparatively young as a manager of very large establishments. His merit is not in devising useful theories, but in putting them in practice. And, not to swear too loudly by a "young" manager, we will quote again from the late Sir George Findlay, General Manager of the London & North Western, who wrote, about 1890, after a lifetime of experience:

"The true preventive of strikes is to be found in *the cultivation of a good understanding between the men and their employers*, and in the establishment of sick, accident and benefit funds fostered and assisted by the directors, so as to show that the employers take as great an interest in their moral and material welfare as a private employer would do in the case of valued servants."

That is our text; and Mr. Vreeland has related the experience which constitutes the "sermon." We have called him "young"; but his nine years' record is too long to have been made good by accident; so no one can object to his testimony on that account. And to any one who objects to Sir George's testimony, we may say that in his long career he had few strikes—no expensive ones, we believe—and, what should be significant to railroad managers of the present day, he always refused to discuss employees' grievances with anybody but employees, and never saw the secretary of the Amalgamated Society of Railway Servants. This we have on the authority of his biographer. Sir George evidently made his conduct match his theories.

We have italicized what we deem the main part of the quoted paragraph, because the establishment of relief funds *may* be a cold business move; may depend for its success partly on a money-bargain, in which the employees, coming in voluntarily, may be kept in by what amounts to financial coercion—by exposure to loss if they go out. A "good understanding," however, must always be entirely voluntary on both sides throughout its existence.

About the only thing we have to say concerning Mr. Vreeland's recent utterance, besides asking the reader to go over it a second time, is to make prominent the utter simplicity of the things to which he gives the credit of his success. The president of the company was present at 106 out of 108 monthly meetings of employees; an exceedingly commonplace duty, faithfully done; and yet who shall say that that assurance to the men that they could have frequent hearings was not a vital factor in the long-continued industrial peace which has been so profitable to the company? Every railroad man knows how peace between railroad companies in traffic matters has been broken, to the great injury of all concerned, by the mere absence of a representative from a regular meeting. Is not the same principle an important element in the relations between employer and employee? With men and corporations, as with cabinets and nations, a silence is often the first irrevocable step in a war.

Half our troubles are due to unfit foremen, says Mr. Vreeland. Translated, this means that a president who wishes to succeed must have the grit to discharge a cold and unsympathetic foreman, even if he is efficient as a mechanic, an engineer, or an economist—or efficient in everything else. Getting along well with the men is a prime factor, never a secondary one.

Mr. Vreeland has a great advantage over most railroad managers in the density of his force—if we may adapt a traffic term; in the facility with which he can quickly communicate with every employee. The great success of the late Colonel Hain as manager of the Elevated roads was due in part to the same advantage. But, surely, in these days of the telephone, the telegraph and fast locomotives the energetic manager is not going to let mere distance thwart his efforts to keep in perfect touch with his men. Not that he can address crowds through the telephone; that feat is still a curiosity rather than a practical business instrumentality; but he can inspire his division officers and unify their acts in a way that was not possible a few years ago. It is not impossible to impart the force of personality by telephone. At least, it can be done far more effectively than by telegraph or by printed circular in cases where there is only an hour in which to do it. Distance is, indeed, an obstacle, but the difficulty in getting and keeping perfectly capable division officers is a greater obstacle. In other words, there is not so much difficulty in conveying orders or wishes to 10 places, as in finding 10 men who will fully understand and vigorously execute the manager's plans. This is not a slur on the division superintendent; rather, it is a criticism of those higher officers who too readily allow their efficient superintendents to resign and go to higher positions.

Why should not Mr. Vreeland's plan be tried, cautiously, on roads whose thousands of men are *not* concentrated like those in New York City? We are well aware that "in time of peace to prepare for war" is a doctrine which it is much easier to talk about than to get carried out; but no one denies the soundness of the doctrine. While we are not able to lay down an easy and universal rule by which a general manager can mollify ugly feelings in the breasts of a grievance committee 500 miles away, through a division superintendent who has not yet become fully acquainted either with his manager or his men, we do feel warranted in mentioning one means which should *not* be adopted: and that is a conference, over the heads of the division officers, with a large committee representing the "system." A "good understanding" with employees must be one in which communication between them and the officers is not only free but reasonably constant; and that means that the employees must be able to get at the manager, or his actual representative, without losing time or making a special long journey, or dressing up. "Actual representative" means, of course, a subordinate officer whose word satisfies the men as well as the word of the manager himself.

This last is an ideal that can never be quite fully realized; and this thought brings us to our final point, personality. We have lauded Mr. Vreeland's methods, but have not spoken of his personality. The value of that element in his ability as a leader of men cannot be measured, because "personality" is made up of characteristics which elude accurate description. A general or traveling passenger agent does not usually hold his place long unless he possesses decided ability in pleasing prospective customers. In a general manager or superintendent the ability to please employees is looked upon as a qualification quite different from that of the G. P. A.; the velvet glove must have in it (or have available) a well-defined iron hand; but is not the velvet glove a vital feature?

With the most successful manager, however, the softness appears to be not entirely in the glove; it is partly in the hand. But, again, a soft hand is worthless without a tender heart; and tender hearts are supposed to be somewhat incompatible with marked executive ability. To follow out this line of thought will lead us too far afield, and we must again remind the reader that our main purpose is to get him to look at the facts which we have cited. One thing, however, which is not touched upon in Mr. Vreeland's address, but which we suspect is important, is the great strategic value of taking the initiative. The successful manager is not forever listening to "demands"; instead, he is talking with his men on topics which he himself has brought up.

NEW PUBLICATIONS.

A Handbook for Superintendents of Construction, Architects, Builders, and Building Inspectors. By H. G. Richey, Superintendent of Construction, U. S. Public Buildings. New York: John Wiley & Sons, 1905. 16 mo., morocco, v+744 pages. $4.00.

This volume aims to be an every-day help to any one engaged in building construction. It is divided into six parts, the first three of which treat of the construction of the main part of the building, while Part IV. treats of the interior and exterior finishing of the building, including electric wiring and heating. Part V. is devoted to drawing and mensuration, and various engineering formulas are given. In Part VI. tables of strengths and weights of materials are included, as well as a reference to hydraulics, which is foreign to the title of the volume. After discussing the personality and duties of a superintendent, the method of laying out the foundation, the method of determining the bearing power of the ground upon which the foundation is to rest, the proper load under certain conditions, and the method of designing the footing courses are described. Specifications for piles and foundation timber are quoted and illustrations of concrete piles of different forms and types, and sheet piling made of channels and bars are given.

A number of tables of properties of different building stones are also shown. The headings in these tables are as follows: Location of quarry, buildings used in, color, strength, weight per cubic foot, ratio of absorption, chemical analysis, and the total cash value of the stone used and quarried in the different states during certain years. Stone-cutting, properties of brick, lime, sand, cement, cement-mortar, and concrete are treated in detail and specifications given. This is followed by a tabulation of the proportions of concrete and the thickness to which it is laid in various kinds of work. Expanded metal and fireproof floor construction is described with the aid of a number of small but very clear cuts or figures which not only show the general appearance but give the dimensions of the various parts. This is followed by rules and specifications for lathing and plastering, carpentry, etc.

Thirty-four pages are devoted to electric wiring. Definitions of the terms used, tables of data about copper wire, incandescent wiring, formulas for both inside and outside wiring, and specifications for the same are given. There is an error on page 484: The statement that "one watt equals $^1/_{746}$ of a horse-power" is made, and immediately afterwards that "horse-power $= \frac{\text{watts}}{746}$ or, watts = h.p. × 746," which statements are contradictory.

The foregoing comprises about two-thirds of the book and is better arranged than the balance, which contains a miscellaneous assortment of tables and formulas interspersed with rules and specifications. The strengths and properties of cast-iron, wrought-iron, and steel are given correctly in general, but in some cases the range is too great; and, in addition, in some cases the constants are not properly qualified, viz.: The ultimate compressive strength of wrought-iron is given as "40,000 to 125,000 lbs." instead of pounds per square inch; and the modulus of elasticity of steel is given as "29,000,000," instead of 29,000,000 lbs. per square inch.

In Part V., under the head of Drawing, Laying out Work, and Geometrical Mensuration, some rules of elementary drawing and a description of the orders of architecture are given; also tables for computing the stresses in Pratt and Whipple trusses, and a few simple forms of roof-trusses. The kind of stress in the different members of the roof-truss are intended to be shown by light lines for tension and heavy lines for compression, in the figures given; unfortunately part of these are wrong. The author attempts the impossible in endeavoring to give much of value about roof-trusses and bridges in 11 pages.

The defects noted above are in the part of the book which is not strictly a part of the main subject as indicated by the title, and the volume, particularly the first part, will be of value to inspectors and superintendents of the construction of buildings.

Principal Professional Papers of Dr. J. A. L. Waddell, Civil Engineer. Edited by John Lyle Harrington. New York, 1905: Virgil H. Hewes. Cloth, 970 pages. Price $5.

Dr. Waddell needs no introduction to our readers as an author, engineer and educator. For the last quarter of a century he has been prominently identified with many of the largest engineering projects in the west and in the east as well, and his numerous contributions to the journals of the engineering societies on widely varied topics have strengthened his standing among his associates as a keen, broad minded and able master of his profession. These contributions in the shape of papers and discussions on current engineering topics in which he has always taken great interest have been collected into a large volume by the editor and form a permanent record of the principal achievements of their author in the pursuit of his life work. The editor has paid a charming tribute to his friend in so doing, and has, at the same time, given us a book which is interesting to read and well worth while to keep and to study. The many different papers are arranged in the chronological order of their writing, and each is prefaced by an introductory note briefly explaining the circumstances under which it was written. Where the paper brought out a discussion extracts from it have been reprinted, and a short summary of the whole subject with the editor's comments follows. In this way each paper is intelligently presented and explained. As far as possible, the original illustrations have been reproduced and they are uniformly good.

Dr. Waddell has always been interested in the education and training of young engineers, and in his numerous addresses before the Society for the Promotion of Engineering Education, of which he has long been a leading member, and before the students of engineering schools, he has laid down many helpful precepts and guides to success in his own or any other profession. He has pointed out the things which must be learned and which cannot be learned from books. In this lies their value and added to that is the charm of a literary style which is well worth studying of itself as an example of how an engineer should express his thoughts and state his facts. It would well repay any young engineer to read these papers.

Within the limits of a brief review of this kind it is not possible to point out or comment on the value of all or any of the papers which have been here gathered together. Some idea of their varied scope can be had from the list of contents which includes, Notes on Railroad Drainage, Notes on Railroading, Civil Engineering Education, Engineering Education in Japan, Specifications for Iron and Steel Highway Bridges, Disputed Points in Railroad Bridge Design, Halsted Street Lift-Bridge, Elevated Railroads, Address to Students of Rose Polytechnic Institute, Foundations for Buildings in the City of Mexico, Kansas City Flow-Line Bridge Repairs, Higher Education of Civil Engineers, etc. An excellent index adds to the value of the book for reference purposes.

The Cost of Locomotive Operation.

V.

BY G. R. HENDERSON.

(*Continued from page 316.*)

FUEL.

Acceleration.—When a locomotive starts a train from a state of rest, and continues the acceleration, it eventually reaches a speed where the power of the engine and the resistance of the train equalize. When this occurs, the speed will be maintained, but no further increase is possible until the conditions change. While the acceleration is in progress, the demand on the engine for power will be much greater than when maintaining a speed below the limiting speed. The amount of such power (i.e., to overcome the inertia of the train) is given by equation 8, $R = 95.6 \frac{V}{t}$, where R = the force needed to overcome the extra resistance due to the increase in speed. The solution of this problem is more complicated than any that we have so far discussed, but it can be performed with the same diagrams, Figs. 2 and 7, for instance, or the others, if we wished to consider oil burning locomotives. As an example, let us take the coal burner which we have used so far, represented by Fig. 2, and again superimpose Fig. 7. (See Part IV., issue of March 31.)

If we desire to study a train of 2,000 tons weight back of tender, and on a level track, we can refer to the upper line of the set. The dotted portion between 0 and 5 miles an hour shows the resistance at starting, which we have heretofore stated to be about 16 lbs. per ton, dropping rapidly to 5 lbs. at five miles an hour. The power of the engine starts at 40,000 lbs. and so continues up to 10 miles an hour at point B, when it drops rapidly, as illustrated by curve B-C.

At 27 miles per hour, the power and resistance lines cross each other, so that is the limiting speed for the conditions which we are discussing. At any lower speed the power of the engine (if exerted to its full extent) is greater than the train resistance, so that acceleration is possible. How much is determined as follows:

If we consider first the period from rest to five miles an hour, we must find the excess of power over resistance. The middle ordinate between 0 and 5 miles for speed, and extending from the power to the resistance line, will give us approximately the mean excess of power over resistance. Thus we find that the scale distance from d to d^1 is about 24,000 lbs., and as the total weight of train, including engine and tender, is 2,000 + 150 = 2,150 tons, we have $\frac{24,000}{2,150} = 11.1$ lbs. per ton left for overcoming inertia.

Let us now write formula 8 in the form

$$= 95.6 \frac{V}{R} \quad \ldots\ldots\ldots\ldots (10)$$

and formula 9 as

$$t = 95.6 \frac{V_2 - V_1}{R} \quad \ldots\ldots\ldots (11)$$

It should be remembered that V is speed produced by acceleration in t seconds by force R. From rest to five miles an hour we can therefore write equation 10,

$$t = 95.6 \times \frac{5}{11.1} = 43.1 \text{ seconds.}$$

That is, in 43.1 seconds the train will have reached a speed of five miles an hour if the engine was doing its best. For this period and power we see that coal would be consumed at the rate of 1,250 lbs. per hour, and for 43.1 seconds we should have $\frac{43.1}{3,600} \times 1,250 = 15$ lbs. of coal.

From 5 to 10 miles an hour the distance

from e to e^1 is 29,000 lbs., and $\frac{29,000}{2,150} = 13.5$. Using equation 11,

$$t = 95.6 \times \frac{10 - 5}{13.5} = 35.5 \text{ seconds.}$$

The average coal rate is 4,500 lbs. per hour (as seen by the heavy curves on Fig. 2) and for this time we have $\frac{35.5}{3,600} \times 4,500 =$ 43 lbs. of coal. (Here 3,600 is the number of seconds in one hour.)

By proceeding as outlined, we may obtain the time and coal used between any two speeds. Above 10 miles an hour the rate of combustion is 8,000 lbs. per hour uniformly, and the excess power available for acceleration is given by the distance between the points f—f^1, g—g^1, h—h^1, and i—i^1 for the different speed intervals. We can tabulate these as shown:

Speed interval.	Time, in secs.	Rate of coal cons. per hour.	Total lbs. of coal used.
0 to 5....	43.1	1,250	15
5 " 10....	35.5	4,500	43
10 " 15....	44.6	8,000	99
15 " 20....	68.2	8,000	151
20 " 25....	171.1	8,000	380
25 " 27....	271.5	8,000	625
0 to 27....	634.0	.....	1,313

The whole time needed for acceleration from rest to 27 miles per hour is thus $\frac{634}{60}$ = 10.6 minutes, and the average rate of fuel consumption will be $1,313 \times \frac{3,600}{634} = 7,500$ lbs. per hour. The quantity of coal for accelerating between any intermediate speeds is quickly found from the table given, as from 15 to 25 miles an hour, we add 151 and 380 = 531 lbs.

Braking.—While a large amount of fuel is needed to raise trains to a summit, or to accelerate them to a high velocity (in one case endowing them with potential, and in the other case with kinetic energy) it is not possible to realize anything like this amount of saving when this energy is expended. On easy descents, sufficient to overcome engine and train resistance, but not heavy enough to require braking, no fuel need be used over and above that necessary to care for radiation and leaks. The speed resistance at 20 miles an hour, by formula 4, is 7 lbs. per ton and, from equation 6, we see that a grade of about 19 ft. per mile will just be sufficient to overcome it. ($R = .38\ m$ and $m = \frac{R}{.38} = \frac{7}{.38} = 19$ ft. per mile.) We have previously found, however, that it takes more fuel to ascend a steep grade than it does to run twice the distance on a level, so that a loss is apparent, even if no steam is used in the descent.

If the grade is less than 19 ft. per mile, the engine must work steam to overcome the excess of resistance; if it is much steeper, brakes will be needed in order to prevent undue acceleration. If a stop is to be made on a level in a short distance, the brakes must also be used in order to quickly disperse the kinetic energy, and this means that in either case coal must be burned to compress the air required for braking.

In an article by Mr. F. H. Parke (see *Railroad Gazette*, Jan. 29, 1904) it is stated that an ordinary freight car brake cylinder, 8 in. in diameter with a piston travel of 8 in., consumes about 1 cu. ft. of free air for an ordinary application, giving 50 lbs. per square inch, cylinder pressure. If properly handled one such application should stop a train on a level. By knowing the number of cars in the train it is easy to determine the amount of fuel used in a single application stop. If we consider the train just examined for acceleration, having a weight of 2,000 tons, there would probably be 60 cars back of the tender. The driver brake and tender cylinder would probably be, with the piping reservoirs, etc., equal approximately to, say, 12 cars. Then for one stop we should use about 60 + 12 = 72 cu. ft. of free air. Efficiency tests have indicated in the neighborhood of 3 cu. ft. of free air compressed to 70 lbs. per square inch per pound of steam consumed by the air pump; therefore, we should use for the train which we are studying $\frac{72}{3} = 24$ lbs. of steam for a single full equalization application. We can assume that our coal evaporates 6 lbs. of water for each pound burned in the firebox, in accordance with Fig. 3, so that $\frac{24}{6} = 4$ lbs. of coal would actually be used in making a stop. Leaky train pipes will require running the air-pump even when brakes are not applied, but it would be practically impossible to estimate this amount, unless we knew the speed at which the pump was running. In the tests referred to the pump (an 8-in.) made about 75 strokes a minute and used 5 lbs. of steam. A speed of 150 strokes should never be exceeded, which would require 10 lbs. of steam per minute, or 1⅔ lbs. of coal. A 9½-in. pump would use about 2½ lbs., and an 11-in. pump 3⅓ lbs. of coal, a minute, if worked at the maximum advisable speed. Some idea of the amount of fuel required to maintain pressure in a leaky train line may be thus gained from the speed of the air pump. It is not an infrequent occurrence to find the pump working at full speed to maintain the pressure on a long train, and some roads are even applying two air pumps to a locomotive. Of course, the leaks should not occur, but conditions must be often met as they exist.

Stopping.—By combining the data under the last two headings we can determine how much fuel it requires to make *a stop*, that is, to stop a train and again bring it up to normal speed. Thus we found that 4 lbs. of coal would be needed for one full application of the brakes on our 2,000 ton train; we previously determined that it would require 1,313 lbs. to accelerate this same train from rest to 27 miles an hour on a level, which with the engine selected would require 10.6 minutes. But in order to state the *effect of the stop* on the coal pile, we must also determine how much would have been used if the train had continued on its way without stopping.

Freight cars are ordinarily provided with braking power up to 70 per cent. of their light weight; locomotives, including tenders, will probably average about 70 per cent. of their weight in working order. The friction of the brake-shoe against the wheel is an uncertain quantity unless all the elements which enter into the problem are known. (This is fully discussed in "Locomotive Operation," recently published, by the writer.) For the purposes of calculation we will consider it equal to 20 per cent. of the applied pressure. In a 2,000-ton train of 60 cars it is probable that the cars and their load would have equal weights, so that we should have for the retarding force back of tender, 1,000 tons × .7 braking power × .2 brake-shoe friction = 140 tons, or 280,000 lbs. resistance. For the engine and tender we have 150 tons × .7 × .2 = 21 tons, or 42,000 lbs. The total resistance of the brakes will be therefore 322,000 lbs., or 322,000 ÷ 2,150 = 150 lbs. per ton. The average resistance to motion on the level will average about 8 lbs. per ton, making the total retarding force 158 lbs. per ton. Now we can invert equation 8 and obtain

$$S = 70 \frac{V^2}{R} \quad \ldots\ldots\ldots\ldots \quad (12)$$

so that we can obtain the distance of the retardation thus:

$$S = 70 \times \frac{27^2}{158} = \frac{70 \times 729}{158} = \frac{5,103}{158} = 320 \text{ feet,}$$

and from formula 10, the time will be

$$t = 95.6 \frac{V}{R} = \frac{95.6 \times 27}{158} = 16 \text{ seconds.}$$

To determine the distance required in which to accelerate this train to 27 miles an hour, it is necessary to write equation 9, $70 \frac{V_2^2 - V_1^2}{S} = 95.6 \frac{V_2 - V_1}{t}$ and dividing each term by $V_2 - V_1$ we obtain

$$70 \frac{V_2 + V_1}{S} = \frac{95.6}{t} \text{ or } S = \frac{70}{95.6} (V_2 + V_1)\, t = .733\ (V_2 + V_1)\, t \quad \ldots\ldots\ldots\ldots \quad (13)$$

And as the values of V_2, V_1 and t have already been calculated for this train, under the heading acceleration, we can write as follows:

V_1 to V_2	t =	S =	s =
0 to 5.....	43.1	.733x 5 x 43.1	158 ft.
5 " 10.....	35.5	.733x15x 35.5	390 "
10 " 15.....	44.6	.733x25x 44.6	815 "
15 " 20.....	68.2	.733x35x 68.2	1,750 "
20 " 25.....	171.1	.733x45x171.1	5,650 "
25 " 27.....	271.5	.733x52x271.5	10,350 "
Total.....	634.0		19,113 ft.

The total distance from 0 to 27 miles per hour again is evidently 320 + 19,113 = 19,433 ft., requiring 634 + 16 = 650 seconds, or 10 minutes and 50 seconds. Now if the train had not slowed up it would have used 300 lbs. of coal per mile, and as the distance just figured is $\frac{19,433}{5,280} = 3.68$ miles, the coal consumption for the distance would have been 3.68 × 300 = 1,104 lbs., so that by making the stop just discussed the increase in coal used is 1,317 — 1,104 = 213 lbs. over what would have been needed if no stop had been made. These calculations require considerable time, but the question is often mooted, "How much does it cost to stop a train?" and it was felt that this treatise would not be complete without considering this point.

Weather.—In discussing the subject of resistance we alluded to the fact that is often necessary, from cold or storm, to reduce the rating or load hauled by locomotives. This causes an increase in fuel per unit of work done in direct proportion as the load is reduced, as the engine is expected to exert its regular amount of power in any case. If it be considered necessary to reduce the load 10 per cent. for instance, we shall have an increase of 11 per cent. in fuel per ton-mile, as the full amount of coal will be used on 90 per cent. as much load, and $\frac{100}{90} = 1.11$, or 11 per cent. more coal per ton is allowed. If a 20 per cent. reduction is made we have $\frac{100}{80} = 1.25$, or 25 per cent. more coal for the unit of work. We see at once that such reductions on account of winter or severe weather will be sufficient reason to account for a considerable advance in coal consumption as such season approaches, but it is necessary to do this in order to get traffic over the road; if the load is not reduced great detentions are sure to occur, assuming, of course, that the engine has a full rating for good weather. The fact that the weight of the engine and tender is thereby distributed over a smaller train also adds to the increased cost.

To show that this effect is reflected promptly by the reports, we give below the pounds of coal used per 100 ton-miles in freight service (including weight of cars) for the Chicago & North-Western Railway throughout two consecutive years:

Months.	Coal pr 100 ton-mls.		Months.	Coal pr 100 ton-mls.	
January....	25.5	25.0	July.....	19.0	19.0
February....	27.0	28.0	August.....	19.5	21.0
March.....	26.0	24.0	September...	20.0	22.0
April.....	22.0	23.0	October.....	21.0	22.5
May.....	21.0	23.0	November...	22.3	24.0
June.....	19.0	18.5	December...	25.0	24.5

In each year given February required the most coal per unit of work done and June and July the least. No doubt some of the

variation was due to traffic conditions, but the general effect of the weather is very prominent throughout the period covered. As it is impossible to say *exactly* how much increase will be caused by weather alone, we shall not attempt to go further into this subject. It is evident that the question of fuel cost is very complicated, if we attempt to allow for all the variations of conditions which may be expected some time or other. The main questions that are likely to arise, however, such as the increase in fuel consumption due to different schedules of speed, methods of loading, change of grade, etc., are not difficult of solution, especially as they ordinarily represent a *difference* between two or more possible conditions, and while some or many of the various causes which we have noted may arise to seriously affect our calculations as to *total quantities*, they would probably exist under either of the special methods of operation which are being considered, so that the *difference* would not be seriously affected. For such purposes we therefore believe that our methods of computation may be accepted with confidence.

(To be continued.)

Indiana Railroad Commission Law.

The law passed in February last by the Indiana Legislature to establish a railroad commission consists of 25 sections and fills 20 pages. The commission is to consist of three persons, to be appointed by the Governor for terms of four years each, the terms to expire in rotation. There must never be more than two members belonging to the same political party. An appointee must be 30 years old and each commissioner must give a $10,000 bond. The salary is $4,000 a year. It is a misdemeanor for any member or employee to accept free transportation or any gift, etc., from a railroad or a party interested in railroad transportation; fine, $50 to $1,000.

The Secretary's salary will be $2,500, and the title of the board is "Railroad Commission of Indiana." Ordinary expenses are to be approved by the State Auditor; but traveling expenses, which must include only transportation and hotel bills, must be sworn to, and will be paid only on the order of the Governor and after approval by the commission.

The commission is to supervise tariffs, car service, transfer of freight, establishment of sidings and of crossings; is to correct abuses and prevent extortion. The railroads of the state must have a uniform freight classification. The commission must make reasonable joint rates, if the railroads fail to agree, and may apportion them; and must prescribe transfer and switching charges where the railroads neglect the duty. The commission may alter, amend or abolish any classification or rate. It is to hear and determine complaints, enforce reasonable rates for carrying freight, for storing and handling and for the use of freight cars when not promptly unloaded; enforce reasonable passenger rates and rates for all other services performed by any railroad.

Rates must be corrected only where some party is injured and files a written verified complaint, and only after hearing; and an order granting relief shall operate for the benefit of all other parties situated similarly to the complainant on the same railroad. At hearings of complaints, the testimony must be taken down in shorthand and the record preserved.

In changing rates, the board must give the railroad 20 days' written notice. The commission may enforce attendance of witnesses, etc. Rates established by the commission must be accepted by the courts as reasonable unless found otherwise by formal process in a direct action brought for that purpose.

A railroad dissatisfied with a rate prescribed may, within 90 days, lay the record before the Appellate Court of Indiana, and such cases are to have precedence over all other civil cases and shall be determined as speedily as possible. The decision of the Appellate Court is to be final.

If a railroad is dissatisfied with orders requiring the construction of side tracks or of railroad crossings, or concerning transfer of cars, it may appeal to the Circuit or Superior Court of the county; and the suit shall be tried in equity without a jury; appeal may be taken to the Appellate Court.

Orders of the commission are to be in effect at the time fixed by the commission, but a railroad objecting and appealing to the court may, by filing a bond, continue to charge the old rates; the bond must run in favor of all shippers and passengers, and every shipper and passenger must receive a certificate setting forth his right to a rebate if the company loses its appeal. Such rebates must be paid within 30 days under a severe penalty. If a railroad complains of a rate, the burden of proof is on it to show unreasonableness.

Each railroad must print and post tariffs as prescribed by the commission and must not change a classification or rate except after 10 days' notice to the commission.

The commission may require the attendance of persons and the production of papers; refusal to allow the inspection of books or papers subjects the offender to $500 fine for each day, and the person refusing will be deemed guilty of misdemeanor.

The railroads must at once furnish the commission with all tariffs, etc.

The commission is to make an annual report to the governor and may prepare blanks for eliciting information from the railroads; refusal to fill out the blanks is punishable by $500 fine.

If the commission finds interstate rates excessive or unlawful it shall notify the road and may apply to the Interstate Commerce Commission for relief.

The railroads must issue receipts to consignors of freight and are forbidden to limit the negotiability of any bill of lading; neither shall they limit its common law liability.

Witnesses before the commission are to receive $2 a day and 3 cents a mile for traveling; contempt on the part of a witness may be punished by a court, the commission making application therefor.

Section 13 declares that the collection of rates above or below those approved by the commission is extortion and prescribes a fine. Section 14 forbids rebates; unjust discrimination, etc., in great detail, and requires freight to be received without discrimination, except that perishable freight shall have precedence. This section includes a long and short haul provision and imposes fines up to $5,000. It allows reduced rates and free carriage to the government, to indigent persons, etc. Section 15 prescribes a penalty for false billing, false weight, etc.; also for receiving a rebate or concession, under penalties up to $1,000.

Section 16 makes a railroad liable in damages for any act or omission contrary to the law, but a road may plead in defence an unintentional mistake. Section 20 makes it the duty of the commission to enforce all laws concerning railroads, and suits of this nature shall have precedence in the courts over all other civil causes. The law applies to express companies, but does not apply to street or interurban railroads except in the matter of interlocking at crossings. Section 23 requires the commission to investigate defects in roadway, bridges, etc., and to make report to the governor and to the road, recommending changes or improvements deemed necessary.

Electric Cabs in New York City.

The New York Transportation Company now maintains in Manhattan a cab service which, both in the scale upon which it is conducted and in the equipment provided for its maintenance, has no parallel in the world. The following table gives the growth from the modest beginning of eight years ago:

	Floor space of operating stations.	Station capacity in vehicles.
March, 1897.....	12,000 sq. ft.	25
November, 1897 ...	24,700 "	100
July, 1899	71,812 "	200
December, 1900 ..	128,000 "	550
December, 1903. ..	158,000 "	700

The company now owns nearly 600 vehicles, the types including broughams, hansoms, landaus, victorias, cabriolets, surreys, omnibuses and tonneaus, and they travel 2,000,000 miles a year. It occupies three stations in Manhattan, the main station at Forty-ninth street and Eighth avenue, a large sub-station at 250 East Sixty-sixth street, and a small one at Vesey street and West Broadway. The main station provides accommodations for 550 vehicles and includes extensive repair shops. Since many of the vehicles are in service both day and night, provision is made for rapid interchange of the storage batteries, by an elaborate equipment by which a discharged battery may be withdrawn from a vehicle and replaced with one freshly charged, in less than two minutes.

Current for charging the batteries is taken from the high-tension mains of the New York Edison Company, the Transportation Company owning and operating its own rotary converter. The company is the largest individual consumer of Edison power in New York City. By far the greater portion of its consumption is during the early morning hours, from midnight to 5 a.m., which renders it perhaps the most desirable consumer as well as the largest.

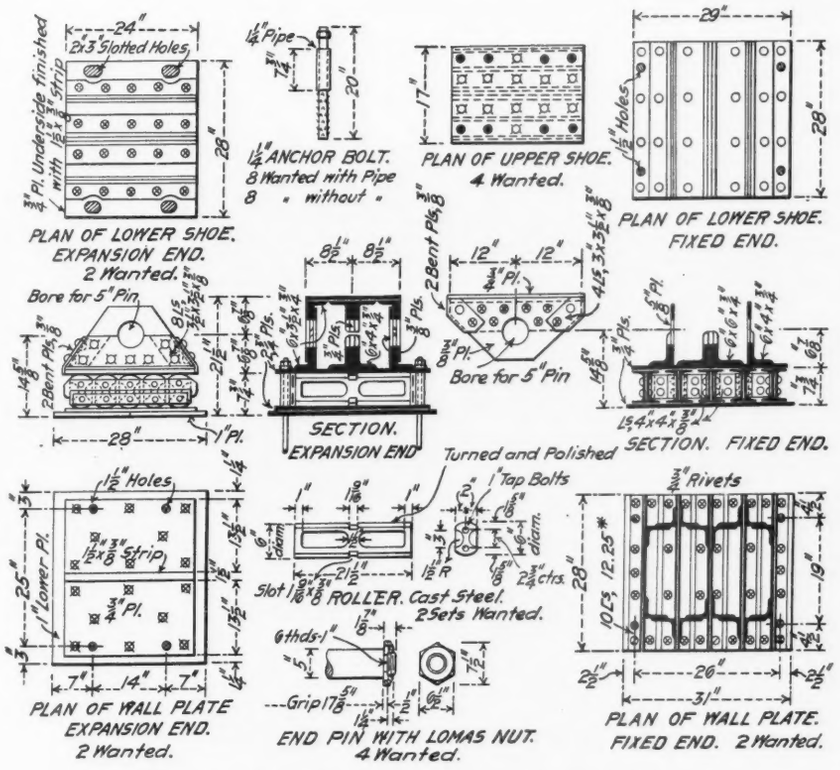
Except that the vehicles are self-propelled and that its activity is on so large a scale and so diversified in character, the methods of conducting the service are not unlike those of high-class livery concerns. Vehicles cannot be hailed from the curb, but are to be had on receipt of telephone or other message at the main station at any hour of the day or night.

The rates compare favorably with the charges made for horse vehicles of high class. Vehicles are also rented by the month, giving the customer the exclusive use of a vehicle and operator; and the company numbers among monthly customers hundreds of wealthy men who prefer this to the maintenance of a private stable. Railroad terminal and hotel service is now being furnished under exclusive contracts. The company also undertakes the storage, care and repair of automobiles and storage batteries.

The company owns the Fifth Avenue Coach Company, the only company possessing rights to operate omnibus lines in the city of New York; and proposes to have some omnibuses. An equipment of gasolene-electric busses, with bodies of the semi-convertible tram-car type, is contemplated, together with the extension of the service to a large mileage of streets in which the company holds franchises, but which cannot be advantageously operated with horse-drawn vehicles.

The Park Carriage Company, another subsidiary company, runs observation automobiles on regular daily sight-seeing tours.

The president of the New York Transportation Company is Mr. R. W. Meade, formerly of the New York Central.

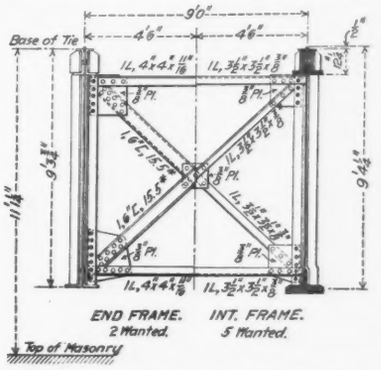


Details of Fixed and Expansion End Bearings for 100-ft. Girder.

Standard Bridges on the Harriman Lines.*

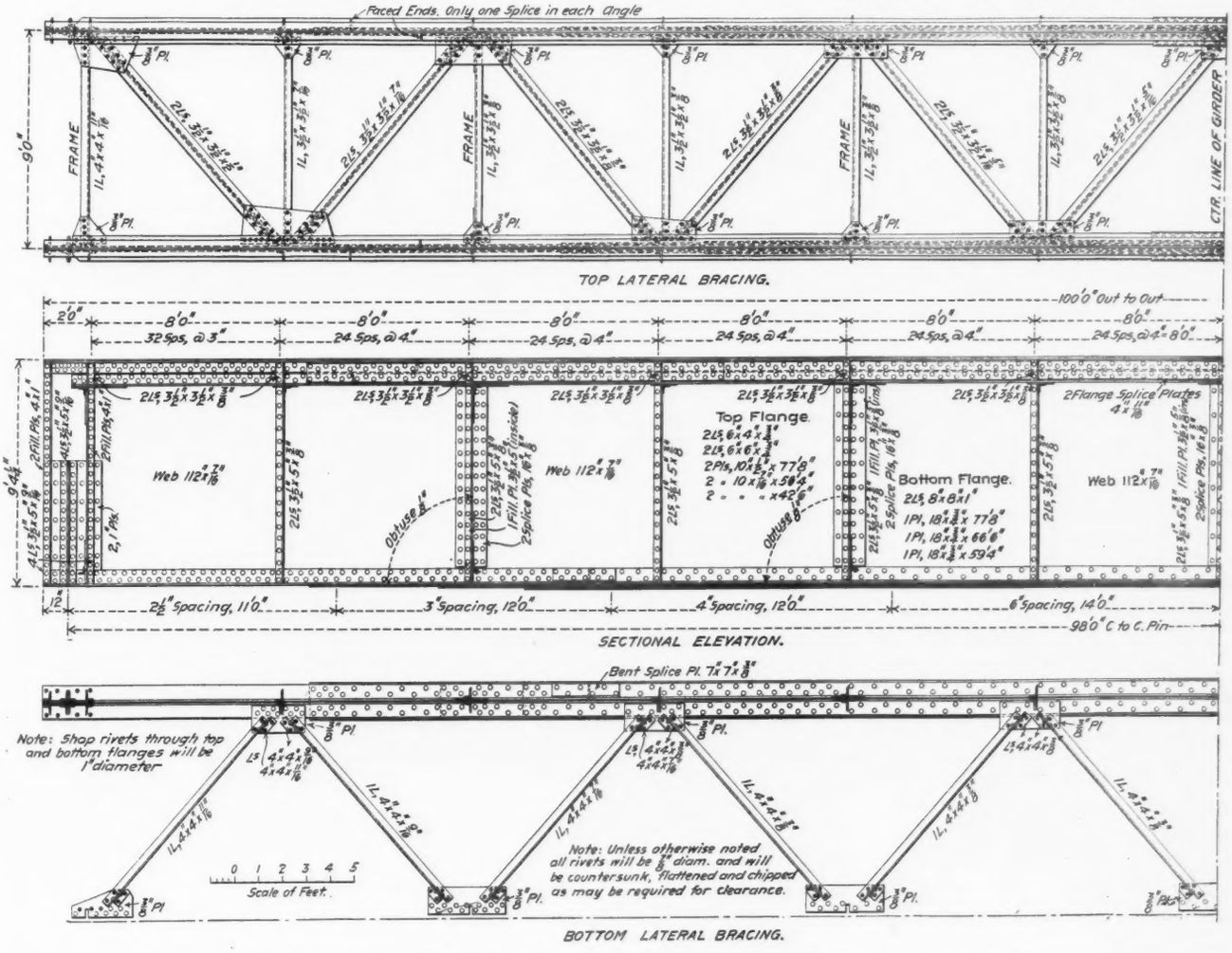
VII.

This week we show the Harriman Lines' standard 100-ft. plate girder which is next to the largest size in use. The depth has been increased only 2 in. over the 90-ft. span shown last week, the additional strength required being supplied by a considerable increase in the amount of metal in the top and bottom flanges. A camber of ⅛ in. is put in in the two end splices of the web plate, but the middle joint is cut with square edges. In the top flange the area of cross-section is 63.51 sq. in. and in the bottom flange 73.50 sq. in., as compared with 51.26 sq. in. and 62.49 sq. in. respectively in the 90-ft. girder. The weight of one span is 137,800 lbs.



Details of Cross Frames for 100-ft. Girder.

*Previous articles appeared in the *Railroad Gazette*, March 17, 24, 31, April 7, 14 and 21.



General Drawing of Standard 100-ft. Deck Plate Girder Railroad Bridge— Harriman Lines.

Electricity on Steam Railroads.*

BY CLEMENT F. STREET.

Electricity for Suburban Service.—The proper handling of suburban service of steam railroads is probably receiving more attention than ever before. In the past there has been a tendency to look upon this service as a necessary evil and any solution of the problem of making it pay a hopeless task. There have been good arguments in favor of assuming this attitude, but the conditions have changed and it is believed at the present time suburban traffic is attractive as a possible source of revenue. One of the changes which has taken place is the elimination of a large portion of purely local traffic which has been mixed with it, and which is undesirable if it must be handled on the same tracks and with the same cars as the suburban. The electric street railways have taken over practically all of this local traffic, and as they are built primarily for the purpose of handling it, it is their legitimate field. With this eliminated, the suburban lines can introduce schedules and equipments designed for purely suburban traffic and handle it efficiently.

The excellent service which the electric street railways have provided has resulted in a wide extension in the area of the territory they serve and the building up of sections formerly looked upon as inaccessible for residence purposes. These extensions have resulted in a corresponding increase of the area served by suburban lines, and there is therefore a demand for a longer haul of the average suburban passenger. It is believed this demand for a longer haul has greatly enhanced the attractiveness of this class of service and makes it possible to realize a profit on lines formerly operated at a loss.

The efficient handling of suburban traffic requires the operation of trains at high speeds through sections which are thickly populated, and also large and expensive terminal facilities. Exactly the same requirements exist in connection with the handling of trunk line service. Both classes require a private right of way without grade crossings, a complete system of block signals, interlocking plants and safety appliances. Many railroad systems having terminals in large cities, have, within the past few years, spent large sums of money in providing these facilities by the erection of depots, abolishing grade crossings, and the introduction of the most modern safety appliances. The expenditure in connection with these improvements has been large, and in order to earn a reasonable rate of interest thereon it is important that they be worked to their full capacity. The handling of through trains requires only a small proportion of the capacity of most of them and it is not believed, as a general proposition, the profits realized thereon will pay interest on the investment. These terminals are useless for the handling of freight traffic and the suburban traffic should therefore be developed and placed on a profitable basis in order to increase their earning power.

Some railroads have been making improvements in the equipment used in suburban service. The character of the cars employed has been improved, and in order to increase the speed at which trains can be operated there has been a large increase in the weight of locomotives. Even these costly improvements are not meeting the competition of electric lines, and if the full earning power of this traffic is developed the adoption of electricity as a motive power is imperative.

*A paper presented at the May meeting of the Western Railway Club.

Some of the benefits which are derived from this change are as follows:

Increase in gross receipts.
Better application of power to trains.
Increased capacity of terminals.
Reduction in operating expenses.
Reduction in terminal costs.
Reduction in cost of maintenance of equipment.
Increased reliability of service.

Increase in Gross Receipts.—When the steam locomotive is abandoned in a suburban service it will be for the reason that it cannot meet the demands of that service. The conditions which exist in our large cities are constantly increasing these demands and even the best is never quite good enough. It needs no argument to prove that a better suburban service can be given with electric than with steam equipment, and all records show that the introduction of electricity is followed by a large increase in gross receipts. Notable instances of this have occurred on elevated railways. On one such road there was an increase of 46 per cent. in the gross receipts, and on another an increase of 68 per cent. in one year. On the Mersey railroad in England the change from steam to electric equipment resulted in an increase of 44 per cent. in the number of passengers carried in the corresponding six months of the year following the change. On one division of the Lancashire & Yorkshire Railway it has been found necessary to make an increase of 62 per cent. in the number of trains run in order to care for the increased traffic following a similar change. Both of these roads handle a heavy suburban traffic and the increase was almost wholly in this service. Additional records of a similar character are obtainable.

All suburban traffic is competitive in one way or another. If a territory is served by only one road, that territory comes into competition with some other territory, and the one having the best service will build up more rapidly. The road giving the best service will therefore receive not only a greater proportion of the existing traffic, but will also secure an increased revenue owing to traffic arising from the building up of the territory through which it runs. Steam railroad officials should not lose sight of the fact that if their suburban service is operated by steam and that in another part of the same city is operated by electricity, they are in direct competition with electric lines and at a disadvantage.

Application of Power to Trains.—A system of traction having power units attached to the trucks of the cars is desirable for suburban service for the following reasons:

(1.) A high rate of acceleration can be obtained.

(2.) A change in the weight of a train does not cause a corresponding change in the rate of acceleration.

(3.) The rate of acceleration can be changed to suit different conditions.

(4.) Switch engines are not required.

(5.) Drawbar strains are distributed.

These are all important in the operation of suburban service and therefore it is not believed that any system of locomotives or other single power units will ever again be extensively introduced into this class of traffic. Figs. 1 and 2 and Tables I. and II. illustrate very clearly the relative accelerating power and flexibility of the two systems. Fig. 1 and Table I. represent approximately the change which was made in the equipment used on the Manhattan Elevated when electricity was introduced. The steam locomotive formerly used on this road weighed about 24 tons and the cars about 20 tons. The electric equipment weighs about seven tons, the motor cars about 27 tons, and the trailers 20 tons. The proportion of motor cars to trailers, the weights of the trains complete and the drawbar pull under the two different systems are given in Table I. The drawbar pull of each system is computed as 25 per cent. of the weight of the locomotive and motor cars. This rating shows a drawbar pull of 12,000 lbs. for the locomotive, which, of course, remains constant regardless of the weight of the train. The drawbar pull of one motor car is 13,500 lbs., which gives 27,000 lbs. for a three-car train having two motor cars and 54,000 lbs. for five, six and seven-car trains, each of which is run with four motor cars.

The lower curve of Fig. 1 shows a comparison of the drawbar pull per ton of train, with steam and electric equipment. From this diagram and Table I. it will be seen that this figure for a three-car train with steam equipment is 142.8 lbs. per ton, while with the seven-car train it falls to 73.1 lbs. per ton. With electric equipment a three-car

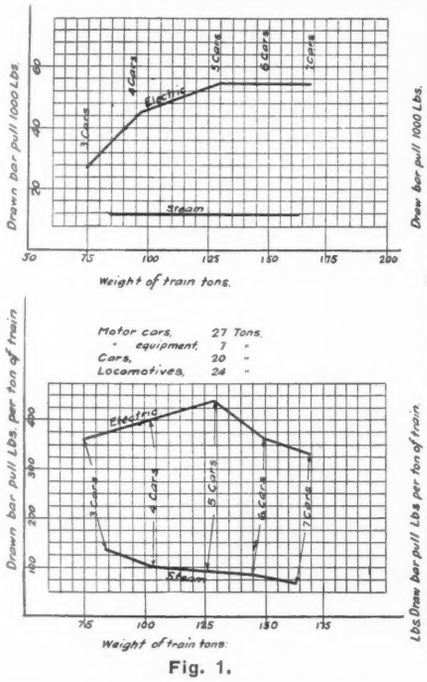


Fig. 1.

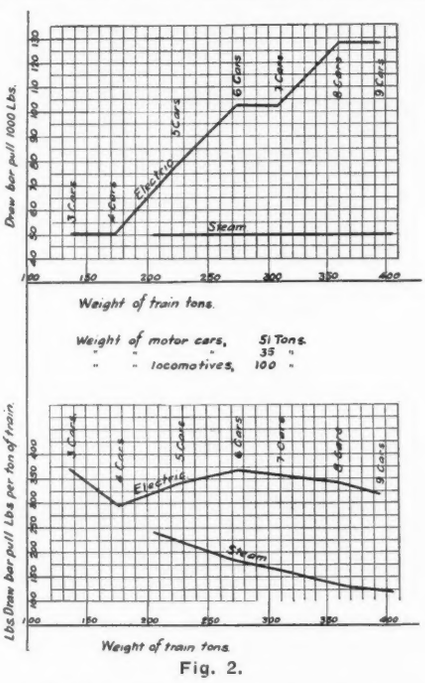


Fig. 2.

train has a drawbar pull of 364.8 lbs. per ton, and seven-car train 329.2 lbs. per ton.

The cars in use on the Manhattan Elevated are much lighter than those in general use for the suburban service of steam railroads and an indication of what can probably be done in the equipment of these heavy cars is given in Fig. 2 and Table II., where a comparison is given between locomotives weighing 100 tons, hauling cars weighing 35 tons, and motor cars weighing 51 tons with trailers weighing 35 tons. Under these conditions it will be seen that with a nine-car train the drawbar pull is 50,000 lbs. with a steam locomotive and 127,500 lbs. with electric motors. With electric equipment it is assumed that five motor cars will be operated with a nine-car train, but it may be found better practice to use six motor cars with a train of this weight, and under this condition the electric equipment will have a still greater advantage.

These tables and diagrams illustrate very forcibly the flexibility of electric equipment and the manner in which the drawbar pull can be adjusted to suit different conditions. If an unusually rapid acceleration is required, there is no reason why trains should not be operated with all motor cars, and on the other hand, where rapid schedules are not essential and few stops are made, one

Table I.—Comparison of Drawbar Pull on Electric and Steam Equipment.

Cars per train.	Motor cars per train.	Drawbar pull per train. Electric.	Drawbar pull per train. Steam.	Weight. Electric equipmt, tons.	Weight. Loco-motives, tons.	Weight. Train. Elec., tons.	Weight. Train. Steam. tons.	Drawbar pull per ton of train, Electric.	Drawbar pull per ton of train, Steam.	Ratio drawbar pull per ton.
3	2	27,000 lbs.	12,000 lbs.	14	24	74	84	364.8 lbs.	142.8 lbs.	2.5
4	3	40,500 "	12,000 "	21	24	101	104	400.9 "	115.3 "	3.4
5	4	54,000 "	12,000 "	28	24	128	124	421.8 "	96.7 "	4.3
6	4	54,000 "	12,000 "	28	24	148	144	366.2 "	83.2 "	4.4
7	4	54,000 "	12,000 "	28	24	168	164	329.2 "	73.1 "	4.5

Table II.—Comparison of Drawbar Pull on Electric and Steam Equipment.

Cars per train.	Motor cars pr train.	Drawbar pull. Electric.	Drawbar pull. Steam.	Weight. Elec. equip., tons.	Weight. Locomo-tive, tons.	Weight. Train. Elec., tons.	Weight. Train. Steam, tons.	Saving in dead weight, favor of electric, tons.	Drawbar pull per ton of train, Electric, lbs.	Drawbar pull per ton of train, Steam, lbs.	Ratio drawbar pull per ton.
3	2	51,000 lbs.	50,000 lbs.	32	100	137	205	68	372.2	243.9	1.5
4	2	51,000 "	50,000 "	32	100	172	240	68	296.5	208.7	1.3
5	3	76,500 "	50,000 "	48	100	223	275	52	343.0	181.8	1.8
6	4	102,000 "	50,000 "	64	100	274	310	36	372.2	161.2	2.0
7	4	102,000 "	50,000 "	64	100	309	345	36	330.0	144.9	2.2
8	5	127,500 "	50,000 "	90	100	360	370	10	344.5	135.1	2.5
9	5	127,500 "	50,000 "	90	100	395	405	10	314.8	123.4	2.5

or two motor cars can be used on a five or six-car train.

The total weight of train as shown in Table I. is very nearly the same for both systems, but when heavier equipments are used as shown in Table II. the electric equipment has a considerable advantage. With three and four-car trains the difference is 68 tons, with five-car trains 52 tons, and with six-car trains 36 tons. A large proportion of suburban service is handled in trains of from five to seven cars and a considerable number of three and four-car trains are operated in this class of service. In view of this fact, this saving in dead weight is important.

Increased Capacity of Present Terminals.—The introduction of electricity is followed by an increase in the capacity of existing terminals for handling trains. During the rush hours of the day these terminals are generally very much overcrowded. There is unavoidably a considerable amount of confusion, dirt and noise, owing to the presence of locomotives, each of which will, in spite of all precautions against it, discharge some smoke and cinders. When a train enters a terminal the usual procedure is—after the passengers leave the cars—for the locomotive to be disconnected, a switch engine attached to the train, the train hauled to the yard and the locomotive switched to the roundhouse. This requires from five to seven switching operations. When a train is made up, it is, as a rule, hauled to the depot by a switch engine and the road locomotive afterwards attached. In some places, where terminals are very much congested, the road locomotives haul their own trains to and from the depot, and where this is done the train must be made up in the yards, where a corresponding number of switching movements take place.

Trains handled by electricity require only one or two switching movements for accomplishing the results outlined. On these trains the motorman merely carries his operating lever from one end of the train to the other, and the throwing of one or two switches is the only operation required for fitting the train for a run in the opposite direction. The making up of trains and hauling them to the depot can be performed entirely by the motor cars themselves and switch engines for this work can be dispensed with.

The limiting feature of the capacity of a terminal is either the track room available, or the number of switching movements which can be made. If track room in the depot is the limiting feature, this limit is extended 30 or 40 per cent., as the handling of electric equipment does not require more than one-half as many such movements as the handling of steam equipment. The rapid acceleration of electric trains is another feature which increases the capacity of terminals, as it enables a more rapid movement of trains than that obtained by the use of switch engines.

Reduction in Operating Expenses.—The introduction of electricity on a large elevated system was followed by a reduction in the total operating expenses of from 13.2 to 9.5 cents per car mile (28 per cent.), and an operating ratio of from 58.1 to 41.2 per cent. of the gross earnings. A portion of this saving is in the cost of power supply and conducting transportation, but the largest saving is in the cost of maintenance of equipment. It is believed that even a greater reduction can be made in the cost of operating suburban traffic on steam railroads, as the conditions under which locomotives were operated on elevated railroads were more favorable than those at most large terminals. The cost of maintenance of locomotives was always very low for elevated roads and the weight of this equipment was only about one-fourth of that in use on a number of suburban lines. The elevated roads were operating under conditions which enabled them to reduce the terminal cost of caring for locomotives to lower figures than it is possible to obtain on surface lines.

All records show that a reduction can be made in the cost of conducting transportation by the introduction of electricity, but it is difficult to secure figures which will enable an exact analysis of each of the items which go to make up this saving. The reduction in the cost of the train crew, however, can be obtained by making a very few figures in connection with any specified service. Figures regarding the cost of caring for equipments at terminals show interesting comparisons, and therefore some of them will be given.

Terminal Costs.—For the care of locomotives at terminal points, roundhouses must be installed and maintained, and as these structures must be of a permanent character, their first cost is high. They must have a complete equipment of steam heating apparatus, an elaborate system of pumps, or other facilities for supplying water, both hot and cold, for use in washing boilers; provision must be made for starting fires, cleaning flues and making light repairs; turntables must be installed, operated and maintained, and in sections of the country subjected to storms of snow and sleet, the expense incident to the operation of turntables amounts to figures of considerable moment. Additional buildings must be provided for supplying the locomotives with coal and sand; cinder pits must be installed and a gang of men employed for removing ashes and cinders; cars must be provided for the removal of ashes from the cinder pits and switch engines employed for handling the cars.

There is such a variation in the first cost of these plants that it is impossible to give even an approximate estimate on this subject. The cost of operation, however, is easily obtained, but there is a wide variation which is governed by the conditions. At one roundhouse where 3,900 locomotives are handled per month the cost is $1.35 per locomotive; at another point where 1,134 locomotives are handled per month the cost is $1.97 per locomotive; at another point where 2,750 locomotives are handled per month the cost is $1.38 per locomotive; at another point where 3,100 locomotives are handled per month the cost is $1.20 per locomotive; at another point where 1,500 locomotives are handled per month the cost is $1.75 per locomotive. The average is 2,476 locomotives per month at $1.53 per locomotive.

The above figures do not in any case include the cost of removing ashes from the cinder pits, cost of handling coal, or the cost of supplying sand and operation of the sand house, or the cost of steam heat and water. These figures refer in all cases to the cost during comparatively warm weather, and also at points where fairly good water is obtainable and only a small number of boilers are washed. At points where bad water must be used, and at these same points during winter months when snow and ice must be removed, these costs are higher.

With electric cars the terminal costs are reduced by about 60 per cent. and the investment in buildings and equipment reduced by 80 or 90 per cent. The following table gives a general outline of about what is accomplished in this direction:

Roundhouse—Eliminated.
Cinder pit—Eliminated.
Washing boilers—Eliminated.
Cleaning flues and grates—Eliminated.
Packing cellars—Eliminated.
Firing up engines—Eliminated.
Turntable expenses—Eliminated.
Wiping—Practically eliminated.
Sand-house expenses—About equal.
Water supply—Practically eliminated.
Coal trestles—Eliminated.

The arrangements made for handling coal and ashes are transferred to the central power house, but owing to the better facilities installed, the cost of doing the work can be reduced.

The care of electric cars does not require expensive buildings, and, as a rule, they are not placed under cover when out of service. Where this practice is followed, the

only building required is a small inspection house provided with pits. In fact, all the arrangements made for the care of locomotives are done away with and the provision made for caring for cars under the present system, with the addition of an inspection and light repair house will prove adequate.

There is some variation in the system of inspection in practice on electric lines. On three elevated railroads the practice is to inspect the motors, all electrical equipment and trucks every three days. At the time of this inspection the motor cases are opened, the commutators and brushes carefully inspected, new brushes applied where required and light repairs made. The amount of time required for doing this work is from 30 to 45 minutes per car and it requires a force the equivalent of about one man for every ten motor cars in service; that is, on a line where 60 motor cars are in service, a force of six men is constantly employed in inspecting motors, electrical equipment and trucks.

On two elevated roads the practice is to make an inspection of each car before it enters the service in the morning. After it has run about half a mile an inspector boards the car and questions the motorman regarding the operation of each portion of its equipment. Motor cars in constant service make an average of 220 miles a day and after they have run about 50,000 miles are taken into the shop and thoroughly overhauled.

The cost of labor for making inspection under each system as above outlined, and also light running repairs, is from 20 to 25 cents per motor car per day. Assuming that six-car trains can be operated by one locomotive or by three motor cars, this gives a terminal cost of about 65 cents for electric equipment and $1.53 for locomotives. Where heavy service is being operated, this difference amounts to from $30,000 to $40,000 per year which is saved by the adoption of electricity.

Maintenance of Equipment.—It is practically impossible to secure any figures which will give an absolute comparison between the cost of maintaining steam and electrical equipment, as there is such a wide variation in the manner in which records are kept. As a rule, the records of the cost of maintenance of electrical equipment are much more complete than those of steam, and as this is a matter in which steam railroad men are vitally interested, some figures taken from these records will be given. The accompanying Table III. gives figures which have been compiled from the reports of 22 electric roads, four of which are elevated and the remainder surface lines. Some of the figures given in this table are shown diagrammatically in Fig. 3. From these it will be seen that the total operating expense per car mile varies from 10.2 to 17.39 cents, and the average is 13.14 cents per car mile.

A very interesting figure is the cost of maintenance of electrical equipment per motor car per year, which, it will be seen, ranges from $34.16 up to $204.34, with an average of $107.20. The wide variation is owing to the condition in which the motors are kept, and also the service in which they are employed. Where the costs are abnormally low, the probability is that a number of new motors have recently been introduced which require a small amount of repairs, or the equipment is not being kept in repair.

It will be noted that the average cost of maintenance for electric equipment of cars per car mile is only .58 cents, which is only 4.33 per cent. of the total cost of operation. This cost includes the maintenance of electric heaters and electric lights, which are used on nearly all of the roads from which these records have been taken.

There is a wide variation in the cost of operation of power plants per car mile, which, it will be seen, varies from 1.173 up to 3.830 cents, with an average of 2.277 cents. This variation is due largely to the conditions under which the different power houses are operated. The lowest costs are for plants having a number of separate units, and when these units are in use they are usually worked to their full capacity. One of the roads for which this item is high, purchases all of its power, but another one showing a low cost is following the same practice. Nearly all of the roads purchase a portion of the power used.

TABLE III.—MAINTENANCE AND OPERATING COSTS ON ELECTRIC RAILWAYS.

Road.	Cars, Motor.	Cars, Other than motor.	Cars, Total.	Car miles per year.	Maintenance: Steam plant, electric plant and cars per car per year.	Maintenance: Electric equipment of cars per motor car per year.	Total operating expenses cents per car mile.	Operation of cars, cents per car mile.	Operation of power plant cents per car-mile.	Maintenance: Equipment, cents per car-mile.	Maintenance: Elec. equipment of cars, cents pr car-mile.	Electric line per mile per year.
A	2,419	641	3,060	45,303,500	$217.94	$98.42	15.60	7.518	1.199	1.470	0.525	†$960.39
B	.....	...	3,280	47,476,702	.....	.....	17.39	.....	*2.695	1.702	.596	409.98
C	.....	...	1,161	14,688,216	.....	.....	15.82	.....	*2.982	1.408	.762	89.42
D	548	0	548	6,849,201	185.66	85.83	11.98	5.804	2.039	1.485	.686	122.72
E	505	127	632	13,524,971	239.58	107.03	11.99	6.165	1.802	1.015	.370	102.63
F	486	2	488	6,296,662	209.96	87.47	16.00	6.333	3.830	1.646	.684	266.25
G	430	51	481	7,350,169	262.94	113.64	12.95	5.668	1.994	1.720	.664	152.86
H	394	0	394	7,627,000	277.62	135.27	13.32	7.534	1.173	1.434	.698	231.63
I	307	56	363	5,165,238	206.75	91.95	15.85	7.115	3.039	1.453	.546	135.01
J	324	73	397	5,590,145	264.12	127.31	15.10	6.352	2.910	1.875	.737	134.03
K	300	0	300	3,334,435	205.17	82.02	13.02	6.606	1.868	1.846	.738	182.00
L	251	0	251	2,449,839	92.02	34.16	11.23	5.873	1.792	.934	.349	44.47
M	232	41	273	4,334,160	270.42	89.90	13.10	5.726	2.430	1.699	.481	142.10
N	231	42	273	4,338,578	297.08	127.44	14.77	7.009	2.821	1.846	.678	144.01
O	226	5	231	5,193,023	392.94	128.83	12.38	5.891	1.644	1.728	.560	135.74
P	220	51	271	5,829,584	335.99	204.34	11.88	5.762	2.180	1.561	.662	112.68
Q	217	12	229	3,207,323	178.76	45.94	11.34	4.825	2.131	1.276	.310	111.15
R	200	34	234	8,179,769	.....	.....	10.50	3.452	1.298	1.502	.....	.....
S	137	19	156	3,012,009	296.62	94.68	12.23	4.987	2.780	1.396	.430	75.42
T	124	34	158	3,770,292	385.00	168.50	11.19	4.927	1.701	1.613	.554	91.88
U	88	271	359	10,953,668	.....	.....	11.40	.....	.....	1.483	.....	.....
V	45	124	169	4,549,920	.....	.....	10.20	4.432	3.512	.802	.....	.....
Avg..	...	...	.....	.....	$254.03	$107.20	13.14	.....	2.277	1.495	0.580	$149.11

*Includes maintenance. †Underground conductor.

The costs given for maintenance of equipment includes the maintenance of steam plant, electric plant, cars, electric equipment of cars and shop expenses. In the majority of cases the two largest items which go to make up this cost are the maintenance of the cars and the maintenance of the electric equipment of cars. The cost of maintenance of the steam plant and the electric plant is so low as to be of very little importance.

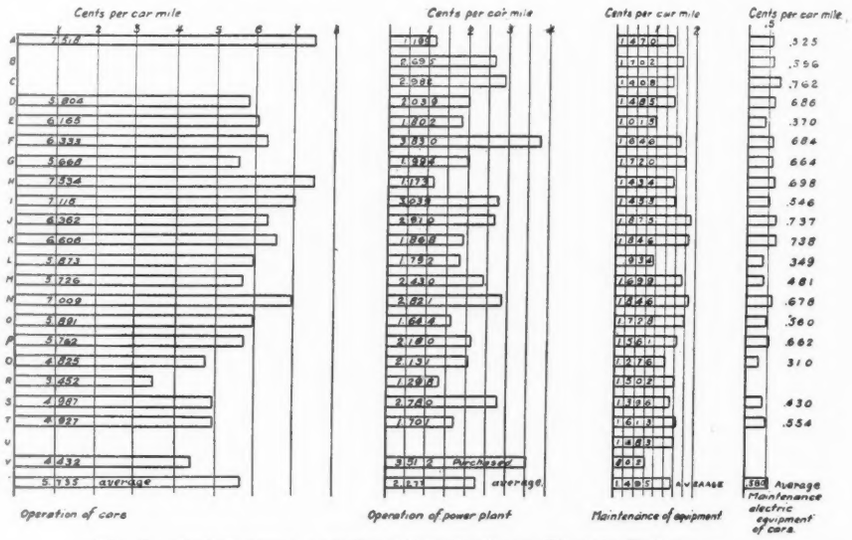


Fig. 3—Maintenance and Operating Costs on Electric Railways.

The general manager of one of the roads states that the total cost of repairs to three generators of 1,500 k.w. and three of 800 k.w. capacity during the year 1904 was less than $700. The maintenance of steam plant, electric plant and cars works out at an average of $254.03 per car per year.

All railroad men know that there is such a great variation in the conditions on different lines that it is impossible to draw conclusions from a comparison of the records of

Table IV.—Cost of Repairs and Renewals of Cars and Locomotives on Steam Railroads.

	Cars: Parlor and sleep'g.	Cars: Private and hotel.	Cars: Dining.	Passenger: 1st-class.	Passenger: 2d-class.	Comb. bag. and pass.	Baggage, mail and exprss.	Total.	Av. cost rep. and ren. per car per year.	No. locomotives.	Av. cost rep. and ren. per loco. per year.
1	...	5	21	976	267	206	628	2,103	$794.65	1,763	$2,066.65
2	143	4	5	1,249	...	257	277	1,935	480.00	983	1,535.42
3	9	7	..	953	8	240	357	1,574	507.07	989	1,164.18
4	2	8	14	496	11	112	262	905	773.46	1,072	2,372.14
5	12	9	11	214	45	20	145	456	1,051.62	601	3,392.87
6	3	..	6	239	11	70	162	491	780.91	765	2,673.57
7	45	4	..	474	..	85	60	668	273.02	186	1,346.37
8	10	..	..	80	15	24	32	161	600.12	149	1,920.54
9	..	1	..	25	22	15	57	120	865.52	162	1,737.62
10	..	2	..	69	2	5	25	103	928.45	146	2,929.84
11	..	..	3	41	9	1	19	73	654.63	166	2,767.64
12	..	..	..	59	..	13	..	72	235.45	15	2,378.11
13	..	..	2	41	11	8	18	80	608.87	231	1,790.21
Total	224	40	62	4,916	401	1,056	2,042	8,741	.....	7,228	.....
Avg..	...	..	..	.....	...	.....	.....	.....	$729.57	.....	$2,212.88

costs of the same operation on two different systems, and this variation extends to different points on the same system. The variation between the conditions of operation and character and weight of equipment on electric street railways and on steam railroads is greater than between any two steam railroads, and there is also a wide variation in the systems of keeping accounts. It is therefore impossible to find any basis upon which to make a comparison between the cost of maintaining the two classes of equipment, but merely as a matter of general interest Table IV. is presented. It will be noted that it includes the average cost of maintaining 224 sleeping and parlor cars, 40 private and hotel cars and 62 dining cars. The cost of maintaining this class of equipment is necessarily high and therefore brings up the average to figures considerably above that of maintaining passenger cars alone. On the other hand, it includes 2,042 baggage, mail and express cars, which would have a tendency to reduce the average figure.

Even after all of the variable features are taken into consideration it is still interesting to note that the average cost of repairs and renewals per year for these cars is nearly three times as great per car as the average cost for maintaining steam plant, electric plant and cars on electric lines. In considering these figures it must also be borne in mind that in the costs given for repairs and renewals of cars and locomotives on steam railroads, a portion of the expenditure is for the building of new equipment, which should not justly be charged to repairs. This is owing to the peculiar system of bookkeeping which is known to exist on some steam railroads.

The figures given for the cost of repairs and renewals to locomotives per year are believed to be a fair average. It is generally understood that the introduction of heavy locomotives which has taken place during the past few years has increased this cost to figures which are somewhat startling. The records of some roads for the year 1904 give the cost of repairs and renewals per locomotive per year at from $3,500 to $3,700.

An item of considerable consequence in connection with the maintenance of steam locomotives is the fact that each one of them must receive heavy repairs on an average of about every 12 months, and as the making of these repairs requires a period of from 30 to 40 days time, a locomotive is only available for service about nine-tenths of the period of its existence.* This results in the tying up of large sums of money without earning power. On roads where facilities and funds are available for keeping the equipment in good condition, that portion out of service for repairs has been held down as low as 7 per cent. On other lines, however, where proper facilities and funds are not available, as high as 25 or 30 per cent. of the locomotive equipment has been out of service undergoing and awaiting heavy repairs. When an equipment is once allowed to get in this condition it requires good management, a heavy expenditure of money and a long period of time to put it in shape. There are cases on record where locomotives have been "farmed out" for heavy repairs and the resultant bills have been fully equal to the actual value of the locomotives after the repairs were made.

Electrically operated cars have a material advantage over the steam locomotive in this regard. The records show that only 2½ to 3 per cent. of the trucks are out of service for heavy repairs, but this is not the controlling feature of the availability of the equipment for service, as from 5 to 6 per cent. of the car bodies are usually out of service for painting and varnishing. The practice is, therefore, to have 2 or 3 per cent. more car bodies than trucks, and when a body is taken to the shop for painting and varnishing, the trucks—if they are not in need of heavy repairs—are kept in service under another body. The trucks are all interchangeable, so that in case one of them needs repairs, it can be replaced by another and the car retained in service. The time required in well equipped shops for removing a truck and putting another one in its place is from 30 to 45 minutes. This makes an extremely flexible system and one under which a large percentage of the equipment can be kept in continual service. The parts of electric equipment which wear out and require renewal are so few in comparison with those on a locomotive that neglect in keeping up repairs does not result in a corresponding deterioration in its condition.

The records of maintenance of electric line per mile per year shows an average of

Table VI.—Analysis of Operating Expenses in Per Cent.—Steam Railroads.

Road.	Column 1. Maintenance of way and structures.	Column 2. Maintenance of equipment.	Column 3. Conducting transportation.	Column 4. General expenses.	Column 5. Operating cost per cent. of earnings.	Column 6. Repairs and renewals, locos.	Column 7. Repairs and renewals, cars.	Column 8. Fuel for locos.
1	19.636	20.350	56.755	3.259	75.84	6.821	3.121	9.529
2	17.870	11.980	67.470	2.680	78.95	4.310	2.657	16.690
3	15.133	13.100	68.431	3.327	76.43	4.750	3.292	19.558
4	12.876	19.438	64.259	3.427	*136.00	9.804	2.698	10.898
5	29.532	17.775	50.883	1.810	77.006	8.354	1.964	9.553
6	21.627	24.713	50.405	3.255	73.38	10.775	2.020	11.820
7	15.369	12.377	68.738	3.516	78.83	5.228	3.809	13.729
8	21.000	18.868	56.566	3.566	73.78	6.476	2.186	12.595
9	25.611	20.375	50.783	3.231	58.21	5.897	2.176	11.467
10	28.224	23.685	46.065	2.026	101.27	8.389	1.881	9.948
11	19.722	15.886	62.553	1.839	80.46	7.450	.751	13.180
12	15.680	14.220	64.743	5.357	65.66	9.065	4.326	10.287
13	12.704	23.573	60.075	3.648	59.33	9.861	1.161	7.608
14	29.850	11.790	50.720	7.640	65.67	3.747	1.666	10.986
15	19.230	16.980	55.940	7.850	85.05	7.267	2.317	9.395
16	24.200	15.390	54.100	6.310	81.22	6.215	1.277	10.251
17	19.710	13.850	58.180	8.260	74.93	5.864	2.112	10.630
18	21.730	18.120	53.600	6.550	77.47	7.434	1.839	8.118
Average	20.539	17.355	57.791	4.308	75.50	7.094	2.291	11.457

*Not included in average.

Column 1 includes: Maintenance of roadway, rails, ties, bridges, fences, buildings, docks and telegraph lines.

Column 2 includes: Repairs and renewals of locomotives, cars, marine equipment, shop machinery and tools.

Column 3 includes: Superintendence, engine and roundhouse men, fuel, water oil and waste, train service and supplies, switchmen, flagmen, and watchmen, telegraph and telephone station service and supplies, car mileage, damages, wrecks, operating marine equipment, advertising, agencies, elevators and stockyards, rents and stationery.

Column 4 includes: Salaries of general officers and clerks, general office expenses, insurance and law expenses.

Table V.—Analysis of Operating Expenses in Per Cent.—Electric Railways.

Road.	Column 1. Way and structures.	Column 2. Maintenance equipment.	Column 3. Cost of power.	Column 4. Operation cars.	Column 5. General expense.	Column 6. Operating cost, pr ct. of earnings.	Column 7. Main electric equipment of cars.	Column 8. Main electric line.
A	7.09	9.46	7.690	56.990	18.770	53.13	3.370	2.839
B	....	....	15.247	.....	.....	69.07	3.427	1.920
C	....	....	18.844	.....	.....	63.74	4.819	1.803
D	2.363	12.400	17.030	48.450	19.740	75.06	5.730	1.249
E	6.480	8.500	15.160	51.700	18.160	60.12	3.100	1.495
F	6.984	10.154	23.914	39.990	18.962	67.36	4.173	1.337
G	13.030	13.258	15.364	43.874	14.474	68.55	5.130	3.057
H	7.871	10.159	8.805	53.613	19.802	71.94	4.950	1.829
I	11.164	9.162	19.163	40.975	19.536	86.39	3.446	2.564
J	10.117	12.433	19.301	42.071	16.078	73.79	4.887	2.715
K	6.408	14.176	14.123	50.736	14.552	55.35	5.667	2.012
L	6.967	8.393	15.966	52.299	16.375	61.03	3.116	1.584
M	10.207	12.996	18.732	47.278	10.787	76.99	3.585	2.374
N	10.146	12.665	19.218	47.457	10.514	78.00	4.593	2.168
O	10.127	14.117	13.284	47.587	14.885	68.70	4.528	2.311
P	5.674	13.447	18.251	43.380	14.284	58.90	5.573	2.451
Q	5.895	11.245	18.783	42.523	21.554	65.07	2.745	2.280
R	7.500	14.651	12.310	32.906	32.633	55.20	.....	.....
S	5.720	11.418	22.632	40.705	19.525	62.13	3.521	2.201
T	4.382	14.416	15.441	45.845	19.916	59.86	4.950	1.576
U	4.869	12.967	.....	.....	.....	59.80	.....	.....
V	6.146	8.067	34.336	43.326	8.125	55.80	.....	.....
Average	7.457	11.704	17.314	45.879	17.298	65.72	4.332	2.093

Column 1 includes: Maintenance of track and roadway, electric line, and buildings and fixtures.

Column 2 includes: Maintenance of steam plant, electric plant, cars, electric equipment of cars, miscellaneous equipment and shop expenses.

Column 3 includes: Power plant wages, fuel for power, water for power, lubricants and waste, miscellaneous supplies and hired power.

Column 4 includes: Superintendence of transportation, wages of conductors and motormen, wages miscellaneous car service employees, wages of car-house employees, car service supplies and miscellaneous expenses, hired equipment, cleaning and sanding of track and removal of snow and ice.

Column 5 includes: Salaries of general officers and clerks, printing advertising, damages, legal expenses, rent, insurance and miscellaneous expenses.

$149.11 for 18 different roads. Some of these are operating a portion of their cars through suburban districts, and all of them operate through large cities where they must contend with a complication of telephone and telegraph wires, also crossings and curves which necessitate a complication of guy wires. The cost of maintaining an electric line on a private right-of-way is lower than the average figure here given. For heavy service catenary cables are used for suspending the trolley wire, which further decreases this cost. It will be noted from the table that the cost of maintaining an underground conductor is $960.39 per mile per year, and owing to this high figure it is not included in the cost of maintaining overhead conductors.

The fact that the percentage of earnings required for operating electric lines is lower than that required for steam railroads is frequently commented on and therefore comparisons shown in Tables V. and VI. and Fig. 3 will be of interest.

Table V. shows the percentage of earnings required for operation, and the percentage of total operating costs required for the maintenance of equipment, cost of power plant, cost of cars, maintenance of way and structures, general expenses, maintenance of electric equipment and maintenance electric line on 22 different street railway lines.

Table VI. gives the percentage of earnings required for operation on 18 of our largest steam railroads. This table gives the percentage of operating expenses required for maintenance of way and structures, maintenance of equipment, conducting transportation, general expenses, repairs and renewals of locomotives, repairs and renewals of cars, and fuel for locomotives. On the steam railroads the maintenance of equipment represents 17.355 per cent. of the total cost of operation, while on the electric lines this represents 11.704 per cent. On the steam railroads the repairs and renewal of locomotives represent 7.094 per cent. of the total cost of operation, while on the electric lines maintenance of electrical equipment of cars represents 4.332 per cent. of the cost of operation. These items are not comparable and are presented only for the purpose of giving a very general indication of the comparative cost of maintaining electric and steam equipment.

Reliability of Service.—The records of a large elevated railway show only one-third as many delays to service owing to failure of equipment since electricity was adopted as there were when operating with steam. These records refer to actual number of delays and do not take into consideration an increase of more than 20 per cent. in the number of trains operated. Some of the officials of this road state that this is the most important benefit which that company has derived from the adoption of electricity. This reliability of service is of even more importance to steam railroads than to the elevated, where suburban service is operated on the same tracks as through trunk line trains, as any delay to the suburban service is not only a cause of annoyance and expense in itself, but is also the cause of annoyance and expense in connection with the through service.

It has been said as an argument against electric equipment that a failure at the power house will tie up the entire service, while if a locomotive fails it does not have any effect on other locomotives operating on other sections of the line. This is true, but the above record is conclusive evidence of the fact that a central power house gives a more reliable service than can be obtained by the use of steam locomotives. In considering this feature of the question it should be borne in mind that the conditions under which steam locomotives were operated on the elevated railways were unusually favorable and the punishment to which they were subjected was not as great as that which locomotives receive in a heavy suburban service on surface lines.

One of the causes for this reduction in the number of failures of equipment is undoubtedly owing to the even distribution of drawbar strains. With electrical equipment these are distributed throughout the train in a manner which compels each car to do its share of the work and it is only reasonable to expect that with such a distribution there will be fewer failures.

Coal Consumption.—Mr. L. B. Stillwell, in a discussion before the International Engineering Congress at the World's Fair in St. Louis, made the following statement:

"The saving in coal with a central station electric power plant over steam locomotives is greater than is often assumed. The plant of the Manhattan Elevated delivers power to the switchboard at the rate of 2.6 lbs. of coal per kilowatt-hour under conditions of full load, and the power is delivered to the motors through the third rail with about 60 per cent. efficiency, giving a consumption of 4.3 lbs. per kilowatt or 3 lbs. per horsepower at a drawbar. A road with heavy traffic and a large and efficient central power station should use only about half as much coal as when using steam locomotives, and this may even be reduced under favorable conditions to one-third."

The cost of electric power per kilowatt-hour is well established by records from large numbers of power stations which have been in operation for many years. This figure, of course, varies with the price of coal. On a basis of coal at $2.75 to $3 per ton, .0050 per kilowatt-hour at the switchboard is a very fair figure, but tests have been made which were as low as $.0036. All records which have been made show very clearly that with a heavy traffic the cost of coal is very much less with electric than with steam equipment. This is a very important item in the question of the cost of operation, but is insignificant in comparison with the large question of furnishing a railroad service which will meet demands and develop the earning capacity of a road to its fullest extent.

Lighting and Heating.—The cost of lighting cars by electricity on the elevated railways is only about 12 per cent. of the cost of doing this work under the systems which were in use before the introduction of electricity. This is, however, one of the smallest features for consideration, as there is no other one thing which adds more to the attractiveness of any service than well lighted cars. The fact that this is recognized by railroad officials is borne out by the large expenditures which are being made for the purpose of equipping cars with electric light, as this is recognized to be the ideal light for all purposes. Where cars are propelled by electricity it is a matter of very small expense to introduce a complete system of electric lights; the cost of power for furnishing them and the cost of their maintenance are insignificant.

The ideal method of heating cars, from an operating standpoint, is by electricity, but the cost of fuel with this system is much higher than by the use of steam. The existing systems can be used for heating at terminals and electric heaters used while the cars are in service. Under either this plan, or electric heaters alone, the cost is a very small item in relation to the total cost of operation.

The remainder of the paper is devoted to a discussion of the development of the two systems of electric traction—direct-current and alternating current—and an enumeration of some of the merits and demerits of each. The author is an advocate of the latter of these two systems, and presents a long list of objections to the use of the third rail for surface lines. The final section of the paper is devoted to descriptions and illustrations of single-phase a.c. apparatus.

Keeping in Touch With Employees.*

"Taking a lesson from my own early experience in railroad work, where employees had no conveniences for spending their spare time either agreeably or profitably, I have introduced on the Metropolitan Street Railway, New York City, a suitable resting place. We have a large clubroom, equipped with billiard tables, gymnasium, library, baths and numerous other facilities, in which our employees congregate. There are seldom less than 500 men there each night, and at the special monthly meetings, which the officers of the company attend, and at which they freely discuss any and every topic that may interest the wage-earner, between 1,000 and 2,000 workmen are present. In nine years I have been absent from only two of those meetings. It is this personal equation between officials and workmen that influences the latter, and I am careful that nothing shall disturb that friendly feeling. This is why we have no strikes. One value of the welfare work is that it gives the employer a voice with the workman. Under ordinary conditions a labor agitator can tie up a whole plant. The men hear his side of the story, but not their employer's. If there is the slightest difficulty arising in our shops, I can post a notice at 3 o'clock in the afternoon asking the men to meet in the auditorium that evening. Two or three thousand attend, and—the agitation is nipped in the bud.

"There cannot be any want among our men. If one of them is burned out at night or needs money for medicine, etc., the matter is reported to me or to one of the vice-presidents the following morning, and his wants are provided for.

"Half of the labor troubles are caused by foremen who do not know how to handle men. The old method was to select a foreman merely with a financial gain for the plant in view. 'How much work can he get out of the force?' was, and is, the question. We test a foreman as to his ability and methods of discipline, but we also carefully investigate his attitude toward the employee. If he is a man calculated to antagonize those under him we do not want him. Every foreman makes a report to me at the end of the month, telling how many men he has discharged and his reason for doing so in each case. If foreman A discharges 50 men in a month and foreman B discharges five, we start an investigation in A's department to ascertain the cause of the trouble. If the foreman is at fault he speedily modifies his conduct, or else we dispense with his services.

"The effect of this good treatment of employees is apparent. Several years ago, when I established a rate of pay based upon the length of time men had been in our employ, I found that only 5 per cent. of them were on the payrolls for five years or more. That was the effect of the old regime. Today 80 per cent. of our employees have been with us five years or more. Every business man will appreciate the effectiveness of the latter force as compared with the former."

*From an address before the Hardware Merchants' & Manufacturers' Association, Philadelphia, by H. H. Vreeland, President of the Metropolitan Street Railway, New York.

Handling Railroad Scrap.*

BY W. G. TUBBY,
General Storekeeper, Great Northern Ry.

With the exception of a few articles, all scrap that accumulates on a railroad has a market value, so that it is of the utmost importance that it be taken care of and turned over to the store department with the least possible delay, to be sorted out, the second-hand usable parts to be taken into store, material that can be repaired to be taken to shops, and the balance graded and placed in bins for sale. The labor involved in handling scrap is expensive, because it is slow work sorting out second-hand material that can be repaired or that is usable from that which is actually scrap and of no further use, and grading it for sale.

At the new Great Northern shops and stores, recently erected at Dale street, St. Paul, the location of scrap bins and the kind of scrap bins to be built was given a great deal of attention, so that scrap received from the shops or shipped in from different points on the line could be handled with the least possible expense. On the Great Northern system all scrap is turned over to the store department as soon as made, or as soon after as convenient, and the proper accounts credited with the value of same, so that all scrap on the entire system is cleaned up each month. Maintenance-of-way scrap that has accumulated at the section tool houses during the month is picked up by the supply cars.

Shop scrap is handled as follows:

All scrap brass is delivered to the storehouse by the mechanical department, with credit ticket made out as fast as it accumulates, and credited to the proper account. On receipt of the scrap brass at the storehouse it is weighed, graded and put in the bins assigned for same, which bins are located in the storehouse, and are kept locked.

The heavy scrap from the machine shop and all from the blacksmith and boiler shops is loaded on cars specially assigned for scrap service at the shops as it accumulates. Credit tickets are made out and turned over to the store department, who have the cars switched to the scrap bins to be unloaded, sorted and graded, and the scrap received is checked against the credit tickets turned in, so that all scrap is credited to the accounts for the month in which it belongs. In this way there is no scrap left scattered around the shops or grounds.

On account of locating the west end of the scrap bins convenient to the door of the machine shop, all turnings and borings and all scrap that can be handled by push car or wheelbarrow is delivered by the mechanical department to the scrap bins with credit tickets daily, and only the large kinds, such as wheel centers, cylinders, etc., are loaded on scrap cars assigned for that purpose; but all scrap from the boiler and blacksmith shops is loaded on scrap cars and delivered to bins for sorting and grading. This is both a convenient and economical arrangement.

At smaller shops all scrap is delivered to the store department daily and credit tickets to the proper accounts turned in on delivery. At locomotive roundhouses and car repair yards the scrap is delivered to the storehouse bins with credit tickets, at the time the requisitions are made for new material; so that the man who delivers scrap to the storehouse sees it weighed and takes the new material back with him.

In the case of car repair yards being located too far from the storehouse to deliver the scrap as removed, it is allowed to accumulate until a certain date each month, when it is weighed and loaded on cars, and turned over to the store department with credit tickets; but in all other cases all scrap is delivered to the storehouse at the time new material is drawn. Scrap journal bearings, however, are delivered to the store at the time new journal bearings are drawn, so that there is always a scrap bearing received when issuing a new one.

All maintenance-of-way scrap, with the exception of rail, is delivered to the supply cars when making their monthly trips at the time the new supplies are delivered. The scrap which has accumulated on the sections during the month is assembled at the tool houses from time to time and the section men are instructed to sort out the different kinds, so that on arrival of the supply cars the different kinds of scrap are quickly weighed and loaded, and credit tickets made out in duplicate and O. K'd by the section foreman and supply car man, the original being sent to the division superintendent for his information to invoice against the store department for the amount and value of the scrap turned over to the supply cars, and the duplicate sent to the store-keeper to check against the scrap received on the car when it arrives and also to check against the superintendent's invoices when received. In this way there is no confusion or misunderstanding. The store department receives the scrap and accepts the superintendent's invoices for same.

When the supply cars collect a load of scrap they bill the car to the storehouse from which they are operated, and another empty car is started out. All track scrap, including frogs, crossings, split switches, switch stands, hand and push cars, tools, etc.—in fact all scrap with the exception of rail—is cleaned up each month and loaded on the cars which accompany the supply cars delivering the monthly supplies. In this way all the scrap on the system is shipped to the stores each month with the exception of scrap rail, this being loaded by division superintendents as often as convenient.

In order to get the best results in handling scrap, it is essential that all concerned be educated to the fact that the different parts must be separated, the usable from what is actually scrap, and the cast or malleable from steel, wrought, etc., as each kind of scrap has a different market value; and also that all scrap must be turned over to the store department as soon as possible and credited to the proper accounts. Also, the store department should insist on old tools and other material being turned in, so far as can be done at the time new material is issued. By this method all scrap is in the hands of the store department practically as soon as it accumulates, when it is sorted, graded, and the usable material separated and put into stock for further service, and the scrap sold at the option of the purchasing agent.

The question of handling the scrap after being received, in order to produce the best results at the least possible expense, which includes sorting out second-hand usable material and material that can be repaired at a cost that would warrant doing so, in preference to scrapping, is a very important one. In the first place, a thoroughly competent foreman, who has a good knowledge of the different kinds of usable material and its use and the grades of scrap, should be assigned in charge of the scrap bins; and steady and intelligent laborers should be assigned him. These men should not be taken off the work so long as there is work to do, as they only become efficient by long experience. It is also advisable and economical to pay one or more of the old, experienced men a few cents per day higher rate than the other laborers with whom they are working, in order that they may be relied upon to retain their positions and watch the other men and see that usable material is not being scrapped or scrap not correctly graded, which is of great importance when loading on sales orders.

To handle scrap economically a proper system of scrap bins should be provided, the floor of the bins being on a level with the deck of cars, and the bins of sufficient capacity to meet all requirements. The bins in the Great Northern shops are 600 ft. long by 38 ft. wide, which includes a platform on one side 8 ft. wide, on which is located a standard gage track for the operation of push cars which are used in moving the different kinds of scrap for delivery to the proper bins. On this platform, in front of the bins, are two track scales on which to weigh the scrap loaded on push cars, which is a convenient and economical arrangement. All cars containing scrap from shops or shipped in from different points on the line are unloaded onto push cars on this platform for delivery to the bins after being weighed.

On the opposite side there is no platform, but a track is located where cars are placed at the bins for loading scrap on sales orders. By having no platform on the sales side, there is no lost ground to travel over in loading scrap into the cars, as would be the case if scrap was loaded on the sorting side. The tracks on each side of the scrap bins lead together at the ends. At the east end they lead to the track scales where all empty and loaded cars are weighed. This prevents delay while switching, as, if a switch is being made on the sales side, the men can be moved over to the sorting side and continue at work until the cars are placed for them to resume loading. Or, if the cars are on the sorting side, being switched, the men can be used in loading or moved over to the main storehouse, which is only a few feet distant, the scrap bins being located parallel to the main storehouse, and connections made at each end by swing bridges which can easily be turned by one man, and thereby kept at work at all times while switching is being done. The west end of the scrap bins is opposite to and only a few feet distant from the door of the machine shop, with a turntable at the end of the incline track from the platform, so that scrap can be loaded on push cars and run over to the incline, turned, weighed on the platform track scales and delivered to the bins in which the scrap is to be placed.

At each end of the scrap bins a number of bins have been roofed over, and in these bins are stored the different kinds of borings and turnings, No. 1 and No. 2 wrought, foundry, coke, sand and ashes, scrap hose, rope and sacking, and other scrap which should be under cover. The balance of the bins are uncovered.

In connection with the economical handling of scrap I would not recommend contract labor unloading, sorting and grading of scrap at a price per ton, for the reason that there is so much good second-hand, or material that can be repaired cheaply, which would be liable to be scrapped if paid for at a contract price, and the principal thing the contractor would have in view would be the tonnage. The best and most economical competent, conscientious foreman in charge of the scrap yard who knows his business, so that no material but what is actually worthless would be scrapped. The scrap pile furnishes an interesting and instructive object lesson, for there you find the remains of the material that has been purchased new and put into service by the different departments in the operation and maintenance of the road. By studying the breakages, the weakness and defects of the mate-

*Extracts from a paper read at the January meeting of the Northwest Railway Club.

rial taken out of service are located, and if necessary a remedy is provided.

The system of handling scrap on the Great Northern Railway and the results secured have been highly satisfactory, especially so from an economical standpoint, since the new scrap bins at the general stores, St. Paul, have been put into commission.

Mr. Hines on the Commission.

Speaking before the Senate committee on interstate commerce, this week, Mr. Walker D. Hines, of Louisville, formerly counsel for the Louisville & Nashville, said:

"The interstate commerce act, as at present amended, has a twofold object. First, to secure the publication and invariable observance of all tariffs; and second, to prevent the establishment or continuance of any tariff rates which are unreasonable or unjustly discriminatory. It provides that the Interstate Commerce Commission shall hear and determine the complaints of anybody and everybody, whether directly interested or not. If the commission finds any rate to be unreasonable or unjustly discriminatory, the carrier must be ordered to cease and desist from continuing to charge that rate. If the carrier does not comply with such order, the commission or any person interested may bring suit, and it becomes the duty of the Circuit Court to afford a speedy hearing and to make and enforce a decree compelling obedience to the commission's order if that order is found to be lawful. On any such hearing the commission's findings are prima facie evidence as to every act found, so that the presumption is always in favor of the commission's order."

An appeal lies to the supreme court from the decree of a circuit court in any such case, but contrary to the general impression, this appeal cannot suspend or postpone the taking effect of the decree of the circuit court. If the circuit court decrees obedience to the commission's order, the carrier must at once obey it, notwithstanding any appeal, unless the circiut court itself is of the opinion that justice demands that it should suspend the operation of its decree pending the appeal, and so orders; and if it so orders it can impose such terms as it sees fit upon the carrier as to giving bond or otherwise.

A distinct and very important procedure is provided by the Elkins act, whereby as to any unjustly discriminatory rates the commission may in the first instance and without any formal hearing or order, bring suit in the circuit court to enjoin a continuance of the discrimination. This avoids all the delay incident to a formal hearing before the commission. Although the applicability of this procedure to unjust discrimination in tariff rates even between different localities has for more than two years been expressly declared by the Supreme Court to exist under the Elkins act, and although it is evidently a convenient and speedy way of preventing unjust discriminations, it has never been resorted to in a single instance.

The Elkins act likewise makes full provision for advancing a case brought by the Interstate Commerce Commission and securing the earliest possible hearing in the Circuit Court before three judges. Although the act has been in force considerably over two years, these provisions for avoiding delay in the Circuit Court in any case brought before it to enforce its order, or to prevent unjust discriminations in tariff rates, have never been availed of.

Thus there is in the present law definite provision for the correction by the courts of every unreasonable or unjustly discriminatory rate, with special provision for the speedy disposition of all such cases, and with special provision to prevent any delay on account of appeals by the carrier. Therefore the widely prevailing impression that under the present law carriers may at their pleasure and without control, charge unreasonably high and unjustly discriminating rates, is thoroughly erroneous. On the other hand, every rate charged by a carrier is subject to the direct and effective control of the courts of the United States to prevent such rate from violating the interstate commerce law in any respect. It is the courts and not, as frequently claimed, the carriers, who are the judges of what is reasonable and just under the law.

To belittle the value of this method of correcting unlawful rates, it is repeatedly stated that when the carrier is thus enjoined by a court from continuing an unlawful rate, the carrier can and does comply with the court's injunction, by making some insignificant reduction of charge in its rate, and thus complies with the letter while defying the spirit of the court's decree. This claim is wholly without foundation. No instance can be cited of any such merely technical compliance with the orders of the commission. In the nature of things a responsible railroad company will not invite additional litigation by making merely an insignificant change in any rate condemned by the court.

This preventive method of dealing with unlawful rates was deliberately adopted by Congress, but has never been found insufficient in a single case; and it is therefore an unwarranted attack upon the law to assume without any facts to support the argument that this remedy is worthless; especially when the nature of the remedy and the experience under it go to show that it is substantial and effective.

The numerous failures of the commission in litigation have not been due to any defect in the law, but have been due invariably either to the commission's adoption of illegal methods, or to the commission's mistaken condemnation of practices not prohibited by law.

Since January 1, 1900, since which date there has been the principal clamor as to transportation rates, the commission has made only eleven orders condemning rates as unreasonable. The carriers have substantially complied with nine of these orders without any litigation whatever; of the remaining two, one has been disregarded by the carriers, and the commission has attempted to enforce it in court, but the Circuit Court has found that the commission's order failed to conform to the statute and has moreover indicated that the rate condemned by the commission was not, as a matter of fact, unreasonable.

During this period the commission has made six orders condemning rates as unjustly discriminatory between different commodities and different localities. The result in one of these is unknown; the Circuit Court has found that one of these orders of the commission was wholly without justification on the face; another of these orders is now pending in the court; one of them has been approved by the court, and obeyed in full by the carriers, and the other two were obeyed at the outset without any litigation. During this period six orders have been issued by the commission in long and short haul cases. The carriers have obeyed three of these without litigation and the courts have condemned the other three as without justification under the law. In no instance has there been a mere technical compliance with the commission's order. An additional remedy of considerable importance which is exercised from time to time and which could doubtless be exercised much more freely if its use were encouraged, is that whereby the commission may award reparation to any person aggrieved by the carriers charging any unlawful rate.

There is undoubtedly a somewhat general impression that the act is absolutely worthless. This opinion is undoubtedly due to repeated public declarations by the Interstate Commerce Commission and its members that under the present law the carriers are utterly beyond any control.

Screw Spikes and Tie Plates on the Chicago South Side Elevated.

BY HERMANN VON SCHRENK.

On the South Side Elevated in Chicago, all-heart, long leaf yellow pine ties have been giving a service of about 13 or 14 years. Only a small per cent. of the renewals at the end of that time are due to failures of the timber from decay or checking, except where the wood has been spike-killed under the rails. Except for the mutilation and deterioration of the ties where spikes have been driven, the timber is as sound and serviceable in other respects as when first put in the track. Most of the elevated roads in this country have experimented largely with tie plates, and the South Side Elevated is no exception, plates being used on all ties. The company's experience with plates having flanges, spines or other projections which must be forced into the timber has not been satisfactory for the reason that water invariably finds its way into the grooves or pockets formed by these flanges or spines and produces decay at those points long before the remainder of the spike shows any signs of deterioration. After carefully considering all the types of tie plates and fastenings, the South Side Elevated has now decided to adopt screw spikes and flat tie plates without projections of any kind except a shoulder on the top surface to receive the outer flange of the rail. The type of screw spike to be used is practically the same as that used on the French Eastern Railway, which was illustrated in the *Railroad Gazette*, July 15, 1904. The angle of the under side of the spike head will be made 13 deg. to correspond with angle of the rail flanges. The spikes weigh about 19 ounces each and will be made in the United States. By using flat tie plates and screw spikes it is expected to increase the life of yellow-pine ties not less than five years so that instead of 13 or 14 years service an approximate service of 18 years, or possibly 20 years, will be obtained.

Locomotive Development on the Pennsylvania Railroad 1849-1905.

BY C. H. CARUTHERS.

At the opening of the Pennsylvania Railroad in September, 1849, the largest engines owned by the company were of dimensions given in the following table:

	Passenger.	Freight.
Cylinders	14x20-in.	13x18-in.
Drivers	(2) 72-in.	(6) 46-in.
Diameter of boiler	42-in.	42-in.
Size of firebox	*34x36-in.	*34x36-in.
Weight on drivers	23,300 lbs.	34,675 lbs.
Total weight	44,800 lbs.	34,675 lbs.
Truck wheels	(4) 36-in.	None.
Auxiliary wheels	(2) 46-in.	None.

*Horse-shoe form.

Engines intended solely for shifting purposes had not been built. By September of 1860 the size of engines had been gradually increased. Two had been built in 1857 especially for use as shifters, and during the summer of 1860 experiments were made with a small steam passenger car named "Novelty" which was in a short time sold to another road. The largest engines in use

at this date had the following dimensions:

	Passenger.	Freight.	Shifting.
Cylinders	16x24-in.	19x22-in.	14½x18-in.
Drivers	66-in.	49-in.	44-in.
Diameter of boiler	46-in.	48-in.	43-in.
Size of firebox...	34x52-in.	34x78-in.	48-in.
Weight on drivers.	40,900 lbs.	55,000 lbs.	45,850 lbs.
Total weight	59,000 lbs.	70,000 lbs.	45,850 lbs.
Truck wheels ...	33-in.	28-in.	None.
Type of engine ..	4-4-0	4-6-0	0-6-0

In addition to these there were also 11 Winans' "camels," and eight Baldwin 8-wheel connected engines, all without trucks, and having the entire weight on the drivers. But these could not be properly considered among the regular freight engines of the company, as they were used almost entirely as helpers on the Allegheny Mountains between Altoona and Johnstown.

The real growth, both in numbers and in dimensions, began in the latter part of 1861 and from that time forward many new machines were purchased and many old ones rebuilt with much of original construction replaced by that of improved and heavier designs, until at the end of seven years the equipment had more than doubled in number. At the same time it consisted of at least 70 different types, which tended to increase the expense of repairs both in time required to prepare parts and in the large number of templates, patterns, etc., required for the work.

Various attempts at uniformity of construction in certain types of engines had evidently been attempted, but in 1868 the company adopted a definite classification which divided all engines built thereafter, either in their own shops or in those of other builders, into eight classes designated as A, B, Ciii, Civ, D, E, F and G. Of these five were for passenger service, two for freight, and one for shifting. Many of the parts were made interchangeable in all classes. Engines of other types were to be sold, when opportunity offered, and the older ones were cut up when in need of rebuilding. A prominent magazine devoted chiefly to literature and art, and still published, deemed this standardizing of the Pennsylvania Railroad locomotives of sufficient merit to be written up in almost an entire page of its editorial department, and in this article stated, doubtless with authority, that the system as adopted would "be sufficient to meet the future requirements of the company"; yet in 1871, only three years after the adoption of the system, another type was added known as class H, designed for shifting service and having a tender sloping on its top toward the rear; the "F" of the original eight standards having been the type used as shifters with a saddle-tank but no tender. This form of shifter had been used on the various lines of the company since 1861.

In 1873 four large consolidation engines were purchased from the Baldwin Locomotive Works, and these led to the bringing out in 1875 of a still larger consolidation engine at the Altoona shops. This engine was the first of many built during the next ten years, and added to the classification sheet another type known as class "I."

At the end of five years, in 1880, a passenger locomotive intended for high speed was built at Altoona and known as "K" on the sheets. It used no wedges in the driving boxes, and had 19 in. x 24 in. cylinders, 68-in. drivers, and slab frames from the front driving box back to permit the use of a wider firebox.

Early in 1881 the first and only double-ender ever built at Altoona or owned by the company entered on its career and was designated "class L." The "K" of 1880 had not proven satisfactory, and during the latter part of 1881 a radically different type of engine for fast passenger service was brought out and a number of a similar type were built, but all were known as K, although they had 18 in. x 24 in. cylinders, 78-in. drivers, the firebox entirely above the frames and extending to their outer edges, a sand-box on each side of the boiler under the running-board instead of on the top, solid-end parallel-rods, and the plain English finish on dome casing and other parts instead of the mouldings and other elaborate lines formerly used, together with numerous other details of a minor character.

In 1882 a shifting engine with sloping top tender, but considerably larger in every way than the "H" was built. It was known as "class M." A type of passenger engine was also brought out in the same year known as "A, anthracite," which had 17 in. x 24 in. cylinders and 68 in. drivers, but was almost identical with the K of 1881 in all other respects.

Three new types of passenger engines came into existence in 1883 and were known as classes N, O and P. The year 1885 marked the entrance into service of a small type of shifter having but four drivers, and using a saddle-tank, and noted as class Q; a consolidation freight engine listed as class S, somewhat larger than the I and using a flush-topped boiler, and intended for service on the leased lines west of Pittsburg; and a still larger consolidation with a Belpaire firebox (the first engine to be fitted with it on the Pennsylvania) and known to the company as class R, but to many of the "unregenerate" employees as "The Hog" on account of the propensity it developed to haul larger trains than its predecessors. The building of class I consolidations ceased with this year.

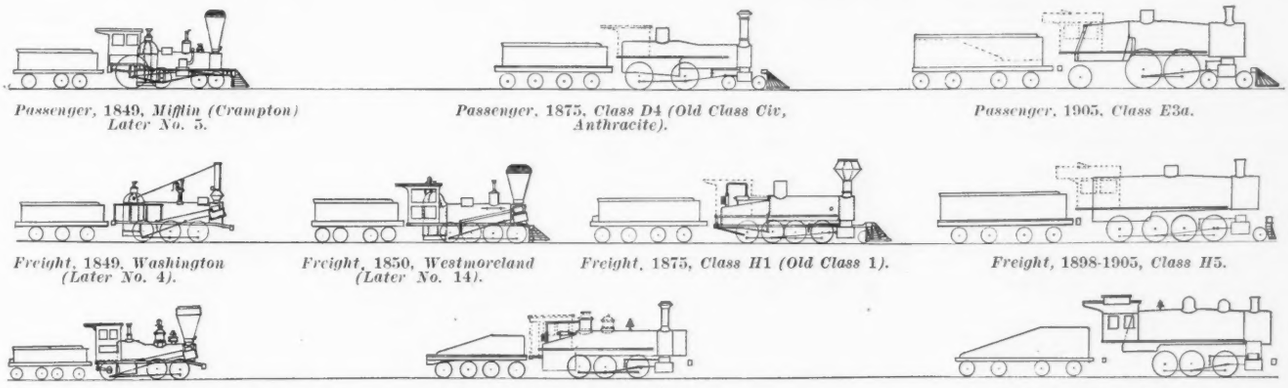
No new developments occurred until 1889, when two types of passenger engines were built, each having Belpaire fireboxes and differing otherwise widely in many respects from any in service up to that time, yet only marked as "modifications" of existing classes. The first compound locomotive of the company's own construction left Altoona under the title of class "T" in 1892. It had one high-pressure and one low-pressure cylinder of 19½-in. x 28-in. and 31-in. x 28-in. respectively, 84-in. drivers, and carried 205 lbs. steam pressure.

A four-wheel shifter with 17-in. x 24-in. cylinders, class U, came out in this same year; and from the shops at Fort Wayne, Ind., a 10-wheel type of passenger engine known as class X.

A large passenger engine with 19 in. x 24 in. cylinders and 80 in. drivers was the notable feature of 1894, but it, too, was only considered a "modification of a modification." In 1895 an engine was brought out similar in many respects to the one just mentioned, but using a boiler of the extended wagon-top type, and 18½-in. x 26-in. cylinders. It, too, was a "modification."

The mogul freight engines came in 1897, and at first bore no letter on their badge plates, but later were assigned the letter F in a new system of classification which was adopted during the year, as the old one had risen in 24 years from eight types to 22, with 15 "modifications" which were, in fact, separate classes. Besides, an English Webb compound, a Schenectady simple, a Schenectady compound, and two Baldwin compounds had been purchased for experimental purposes, and altogether the old "system" was rapidly becoming unsystematized. The new system of nomenclature was described in the *Railroad Gazette* May 13, 1898. The class designations, based on wheel arrangement, are now as follows: (Engines headed to the east, or right of the page). Class A, OO; B, OOO; C, OOOO; D, OOoo; E, oOOoo; F, OOOo; G, OOOoo, and H, OOOOo. Different types of these classes are indicated by numerals and small letters attached to the class letter. The greatest increase in size of engines dates from 1897, as a consolidation known as H4, much larger than any previously built for the company, came out in the latter part of that year. Still larger and more powerful were the two types of consolidation engines which came out in 1898-99 known as H5 and H6.

Between 1900 and 1905 the Atlantic types known as E1 to E3a were placed on the road, together with two classes of large shifting engines designated as B6 and B8, the former of which has piston valves and is only used on the lines West of Pittsburg. During these years the wide firebox was introduced, and also many engines from two of the smaller



Passenger, 1849, *Mifflin (Crampton) Later No. 5.* — *Passenger*, 1875, *Class D4 (Old Class Civ, Anthracite).* — *Passenger*, 1905, *Class E3a.*

Freight, 1849, *Washington (Later No. 4).* — *Freight*, 1850, *Westmoreland (Later No. 14).* — *Freight*, 1875, *Class H1 (Old Class 1).* — *Freight*, 1898-1905, *Class H5.*

First Built for Shifting, 1857, *No. 140.* — *Shifting*, 1882, *Class M (now B3).* — *Shifting*, 1905, *Class B8.*

Locomotive Development on the Pennsylvania Railroad.

types of consolidations were converted into shifting engines by the removal of the truck wheels and the rear pair of drivers. These are now known as B5 and B7.

The accompanying diagrams are to scale and strikingly show the development in size of Pennsylvania Railroad locomotives during 56 years.

New Erie Passenger Locomotives.

To handle the heavy express trains between New York and Chicago over the heavy grades at the east end of the run, the Erie has recently bought from the American Locomotive Company several exceptionally large Pacific type locomotives. A road test was made of the 2,512 last Monday. A train of 10 cars with a total weight of 1,205,650 lbs. was hauled from New York to Port Jervis, and on the return trip another car was added, bringing the total weight of the train to 1,325,450 lbs., exclusive of the engine and tender. These cars, which included three sleepers, a cafe car, a club car and a number of officers' cars, were supposed to represent the heaviest actual service to which the engine will be put in its regular work on trains Nos. 4 and 6. The run from Jersey City to Port Jervis (89 miles), with three stops, was made in 2 hours and 17 minutes; which is about 8 minutes slower than the fastest road schedule, that of train No. 1, but was 7 minutes better than the schedule planned for the trial trip. The fastest time made was 72 miles an hour on the 25-ft. down grade on the lower part of the Guymard hill just east of Port Jervis. The train left Jersey City at 10:32, and in the first hour flat ran 40 miles to a point just beyond Tuxedo, having mounted a total elevation of 467 ft., with one stop, at Paterson. Water was taken at Turner, 46 miles from Jersey City, and up to this point the engine had used 5,039 gallons. The efficient horse power developed up to the point was calculated at about 1,280.

Four Pacific type engines built to this specification have just been put in service, two with superheaters and two without. The accompanying table shows their great weight as compared with other large engines in passenger service. A photograph and specification of these engines will be printed in a subsequent issue.

DIMENSIONS OF THE PACIFIC AND PRAIRIE TYPE LOCOMOTIVES.

Road.	Builders.	Cylinders, ins.	Steam pressure, lbs.	Diam. of driving wheels, ins.	Wheelbase: Driving, ft.	Wheelbase: Driving, ins.	Wheelbase: Total engine, ft.	Wheelbase: Total engine, ins.	Total engine and tender, ft.	Total engine and tender, ins.	Weight: On Drivers, lbs.	Weight: On front truck, lbs.	Weight: On trailer, lbs.	Weight: Total of engine, lbs.
Pacific Type.														
Erie	American Loco. Co.	22½x26	200	74	13	0	33	8	65	1	147,800	36,900	40,300	225,000
Erie (superheated)	" "	22½x26	200	74	13	0	33	8	65	1	149,000	41,000	40,500	230,500
Missouri Pacific	" "	20x26	200	69	12	4	31	8	55	2	124,000	39,000	27,000	190,000
Chesapeake & Ohio	" "	22x28	200	72	12	8	32	8	60	0	150,000	29,000	26,000	205,000
Chesapeake & Ohio	" "	22x28	200	72	12	8	32	8	60	0	130,500	30,000	29,500	190,000
N. Y. Central & H. R. R. R.	" "	21x28	200	75	13	0	33	7½	58	7	131,000	39,000	37,000	207,000
N. Y. Central & H. R. R. R.	" "	22x26	200	75	13	0	33	7½	59	0	140,500	39,000	38,500	218,000
O. R. R. & N. Co.	" "	22x28	200	70	13	4	33	4	62	10	133,000	41,000	40,000	214,000
Soo Line	" "	20x26	200	69	12	0	31	11½	58	7	130,000	36,000	35,000	201,000
Northern Pacific	" "	22x26	200	69	12	0	32	6	61	11	142,000	39,000	37,500	219,000
Northern Pacific	" "	22x26	200	69	12	0	33	0	58	5	132,000	32,000	31,000	195,000
Michigan Central	" "	22x26	200	75	13	0	33	7½	60	5	140,500	42,500	38,500	221,000
Chic., Rock Isld & Pac.	" "	21x26	200	69	12	4	31	10	58	9	130,000	32,000	31,000	193,000
C., St. P., M. & O.	" "	21x28	200	75	13	0	34	1½	59	8½	130,500	32,000	30,500	193,000
Southern Ry.	" "	22x28	220	72	12	6	31	5	61	5	142,000	36,000	40,000	218,000
Southern Ry.	Baldwin Loco. Co.	22x28	220	72	12	6	31	4½	61	8	143,190	37,700	38,800	219,690
Union Pacific	" "	22x28	200	77	13	4	33	4	62	8¾	141,290	37,330	.....	222,520
S. F., L. A. & St. L.	" "	22x28	200	77	13	4	33	4	62	8¾	137,595	41,300	46,400	225,295
A., T. & S. F.	" "	22½x28	220	69	13	8	33	9½	62	10½	140,800	27,680	46,700	215,180
Prairie Type.														
L. S. & M. S.	American Loco. Co.	21½x28	200	79	14	0	34	3	62	5	166,000	27,000	40,000	233,000
L. S. & M. S.	" "	20½x28	200	80	14	0	31	10	57	4	143,000	21,000	26,000	190,900
Chicago Great-Western	" "	20x26	200	68	12	6	30	9	57	0	120,000	22,000	30,000	172,000
Chicago Great-Western	" "	21x26	225	73	13	0	31	8	56	8	132,000	22,000	30,000	184,000
Chic., Burl. & Quincy	" "	22x28	210	69	13	4½	30	8½	62	6	154,000	22,500	36,000	212,500
Chic., Burl. & Quincy	Baldwin Loco. Co.	22x28	210	69	13	4½	30	8½	55	8½	151,070	23,260	34,220	208,550

The Argentine Government is reported to be negotiating a contract with the Southern and Western Railway Companies of Argentina to build a network of suburban roads in some of the most populous districts, the lines to be operated by electricity.

Meeting of the New York Railroad Club.

At the meeting of the New York Railroad Club on Friday evening, April 21, no regular papers were read but a number of subjects to be considered by committee reports at the coming conventions of the Master Car Builders' and Master Mechanics' Associations were discussed by the members of the club.

The first topic was "Water Softening for Locomotive Use," the discussion being opened by a short paper by Mr. L. H. Turner, Superintendent of Motive Power, Pittsburg & Lake Erie. Mr. Turner's paper will be printed in a subsequent issue.

Prof. C. Herschel Koyl, in commenting on the paper, said that in no other mechanical problem did the old adage of an ounce of prevention being worth a pound of cure apply quite so aptly as in the subject of water softening. The best boiler water compound that could be used was pure water. As an example of the effect of bad water he cited a division on a western railroad on which the annual cost per locomotive of using bad water was estimated at $750. Of this amount $360 was due to excess fuel required by reason of poor evaporation due to scale forming in the boiler, $340 was due to repairs to boiler and firebox, and $50 to incidental expense. On this basis nearly $15,000,000 a year is spent by the railroads because of the effect of bad water.

Water softening was not a difficult process, he thought, if carried out in the right way, and almost every water if given the proper treatment could be greatly improved from a boiler standpoint. The first step was to precipitate the foreign matter in solution, and the second step was to clarify the water by removing the suspended ingredients. The chemistry of the first step was simple and well-understood, and the efficiency of the second operation depended upon the mechanical perfection of the water softening plant. In importance, the second step was probably greater since it has been conclusively proven that foaming in a boiler is due to the presence of suspended matter and not to the presence of alkalies. An interesting test had been made some years ago by the speaker on the Rio Grande Western. Two water cars were filled with pure water drawn from a treating plant and then carbonate of soda, a strong alkali, was introduced in the water to the amount of 300 grains per gallon. One of the company's engines was coupled to a long heavy train and supplied with this strong alkali water from the tank cars. The engine pulled the train over the mountains without a sign of foaming.

Mr. Kennicott, of the Kennicott Water Softener Company, said that while water treatment always, or nearly always, helped boiler water, it was not a "cure-all" and never would be. Some waters might be made absolutely pure by treatment while other waters, not so bad originally, could be helped but little.

Mr. G. R. Henderson dwelt on this same point in his brief comments. He also called attention to the practice on the Southern Pacific, on which road a large number of water softening plants have been installed. If after treatment the water still contains 30 grains of solids per gallon it is not considered economical to put in a treating plant. Mr. Kennicott in reply criticized this practice on the ground that any treatment was better than none. He called attention to a plant in operation on the El Paso & Northeastern which delivered water after treatment containing as high as 150 grains per gallon. Although the plant had a capacity of only 5,000 gallons a day it removes from 1,800 to 2,000 lbs. of solids per month which would otherwise go into the boilers of the locomotives and certainly this was worth taking out.

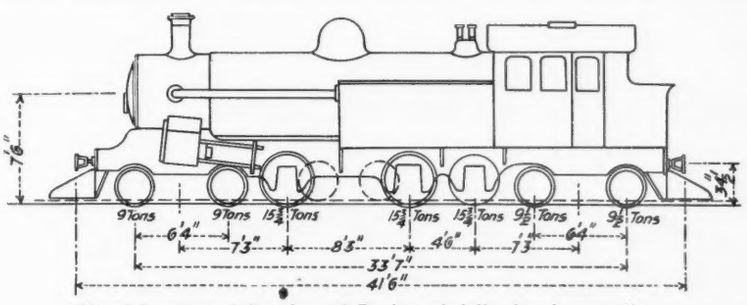
The next topic was "Repairs to Steel Cars," which was opened by a short paper by Mr. R. F. McKenna, Master Car Builder, D., L. & W. He briefly reviewed the work which had been done by the committee of the Master Car Builders' Association and pointed out the necessity of ultimately revising the prices of repairs as at present in force.

Mr. A. Kearney, Superintendent of Motive Power, B. & O., read a paper outlining the work done by the M. C. B. Association committee in revising the 1904 rules for loading long materials. He briefly reviewed the changes which have been suggested and the reasons therefor, and requested the assistance of all railroad officers interested in making suggestions for still further changes if they were necessary or desirable. There was no discussion.

Mr. G. R. Henderson opened the discussion on "Proper Loading of Locomotives." He pointed out that each division of a road must

be considered separately in analyzing the problem because of the many local conditions which affected the question. He had made some comparisons of speed and loading for a hypothetical division 150 miles long, half of which was .5 per cent. up-grade and the other half .5 per cent. down-grade. Assuming a locomotive of given tractive power and also assuming a speed down grade under all conditions of 25 miles an hour he had calculated the cost of hauling 1,000 ton-miles at different speeds working the locomotive at its maximum power up grade. The cost per 1,000 ton-miles at 5 m.p.h. up grade was 66 cents, at 10 miles 66 cents, at 15 miles 62 cents, at 20 miles 73 cents, and at 25 miles 82 cents. The maximum efficiency therefore was at 15 miles an hour, up grade. He had also made some calculations as to the maximum ton miles hauled per month for each of the above speeds and at 15 miles an hour nearly 50 per cent. more could be hauled than at five miles an hour or at 25 miles an hour. These figures would vary, of course, with different assumed or actual conditions. He was of the opinion that entirely too much stress was laid on big train loads by the general managers of many roads. Big train loads looked well on paper records, but they were usually obtained at the expense of heavy engine repairs, much light engine mileage and large amounts of overtime wages paid to engine and train crews.

Mr. F. F. Gaines, Mechanical Engineer, Philadelphia & Reading, read a short paper on the subject of "Motive Power Terminals," in which he suggested an arrangement of re-

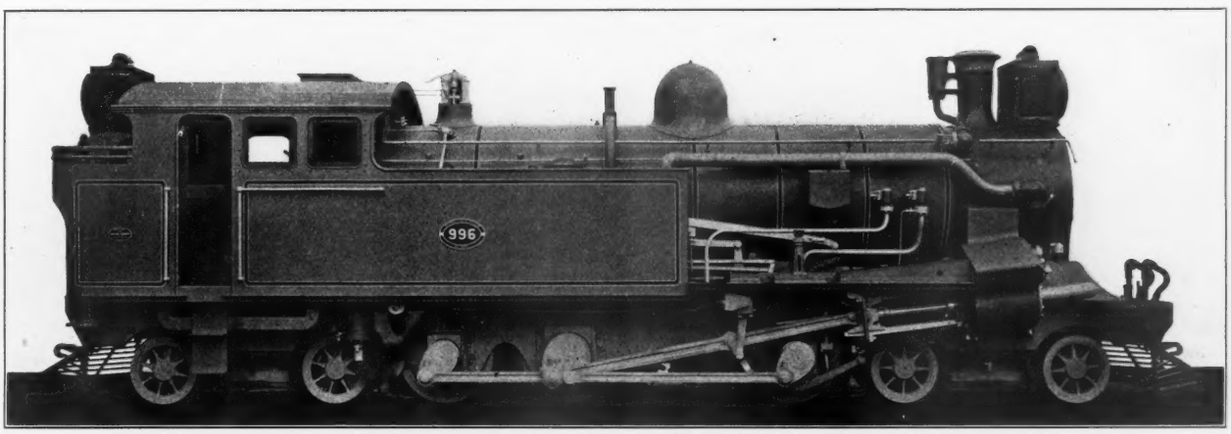


Wheel Loads and Spacing of Rack and Adhesion Locomotive.

lay tracks at engine terminals in connection with the roundhouse. In speaking of the facilities for heating roundhouses he mentioned the possibility of utilizing some of the heat which goes out through the smoke jacks and is wasted. There was no further discussion. Letters were read from Mr. H. H. Vaughan, Canadian Pacific, who was to have opened the discussion on "Locomotive Front-Ends," and from Mr. A. E. Mitchell, Lehigh Valley, who was to have opened the discussion on "Safety Appliances." The meeting then adjourned.

A Freak Locomotive for South Africa.

The management of the Central South African Railways has been making extensive betterments to the property under its charge since the end of the Boer war and has replaced most of the old motive power and equipment in use before the war with modern engines and a large number of high capacity cars. From time to time within the last two years we have illustrated in these columns some of the new and heavy engines which have been ordered from England and also the high capacity rolling stock which has been put into service. The accompanying illustrations show the latest addition to the company's motive power, the engine shown being one of two powerful combined adhesion and rack locomotives recently built by the Vulcan Foundry, Newton-press trains over the exceptionally heavy le-Willows, Lancashire, England. They were designed for assisting the heavy corridor ex-



Combination Rack and Adhesion Tank Locomotive—Central South African Railways.

grades encountered between Waterval Onder and Waterval Boven on the line from Lau renco-Marques to Pretoria. The conditions to be met in the design of these engines were severe and unusual. It was required that they take a train weighing 350 tons with an adhesion engine in front up a grade of 5 per cent. for 3½ miles and help hold the train in passing down on the opposite of the mountain. At the top of the ascent is a tunnel of some length and one of the requirements was that the engines should be fitted with a condensing apparatus to condense the exhaust steam while passing through the tunnel. The gage on the Central South African is only 3 ft. 6 in., so that additional difficulty was encountered in arranging the machinery for the rack engines between the frames.

The engines have a weight in working order of 188,720 lbs., of which 105,840 lbs. are on the three pairs of adhesion driving wheels, 3 ft. 6 in. in diameter. The wheel base is 33 ft. 7 in., and all of the wheels are flanged except the rear pair of drivers. Both the adhesion and rack engines have cylinders 18 in. x 20 in. The outside pair are connected to the middle pair of adhesion drivers and the inside pair drive a coupled pair of cog-wheels which are carried in a frame suspended from the leading and middle driving wheel axles. On account of the restricted space between frames, the main rods of the rack engines are connected to projections of the coupling rods of the rack gear and not directly to the crank pins. The rack axle bearings are adjustable vertically to compensate for the wear of the adhesion driving tires and to further provide for inaccuracy in the adjustment the rack gear teeth are cut in involute form. The teeth of the cogs are cut from steel rings, and these rings are held on the axles with spring keys to compensate for slight inaccuracies in the pitch of the rack. The main frames are outside of the driving wheels and are made up of 1¼-in. steel plate. Joy valve gear is used for both the inside and outside cylinders, each engine being separately reversed with its own screw gear.

The boiler is of the straight top type, with narrow copper firebox, and is designed to carry a steam pressure of 200 lbs. Space is provided for 5,600 lbs. of coal in the cab bunker, and the side and bunker tanks have a combined capacity of 1,200 gallons. Two injectors and two independent feed pumps are fitted in the cab. The condensing apparatus which was required is quite simple. An exhaust pipe is led out from the bypass valve in the exhaust pipe inside the smoke-box and carried back along the side of the boiler to the side tanks. By opening the bypass the exhaust steam is carried back and condensed in the tank by direct contact with the water. The piping in the tanks has been arranged to keep the water circulating, and when running condensing there is very little noise.

Five separate brakes are fitted to these engines as follows: (1) Steam brake on all coupled wheels and truck wheels, (2) hand screw brake on the coupled wheels, (3) hand-worked band brake on the crank discs of the rack engine which have triangular circumferential grooves cut in them, (4) Le Chatelier water brake in the cylinders of the adhesion engine, and (5) a counter pressure air-brake in the cylinders of the rack engine. This last brake consists of a valve in the base of the blast pipe, which, when closed, cuts off the cylinders from the smoke-box and prevents the entrance of hot gases and cinders when the valve motion is reversed and also a pair of in-take valves

in the exhaust pipe which draw in air from outside the smoke-box. The brake is applied by closing the blast pipe valve, reversing the valve motion and drawing in air from the outside and compressing it in the cylinders. Through a graduated discharge valve the air is allowed to escape from the exhaust pipe through a muffler which is mounted back of the stack as shown in the illustration. A small water jet is also supplied to deliver a spray of cold water into the exhaust space to cool the compressed air and prevent over-heating in the cylinders. In addition to this equipment the engines are fitted with an ejector and piping for operating the vacuum train brakes when desired.

The Valtellina Line and the Electrical Operation of Railroad Main Lines.*

BY THEODORE KÖHN.

(*Continued from page* 376.)

VII.—THE ELECTRIC INSTALLATIONS ON THE VALTELLINA MAIN LINE LECCO-COLICO-CHIAVENNA AND COLICO-SONDRIO.

The trial line selected by the "Società Italiana della Strada Ferrate Meridionali Esercente la Rete Adriatica" has numerous curves, long tunnels and many little stations. In Chiavenna the line makes connections for the Engadive and Splügen passes, the Colico-Sondria line provides for traffic over the Bernina Pass and the "Stilfser-Joch." In addition to the heavy tourist traffic in the summer time, a considerable freight business is brought by wine and raw materials for the numerous industries on the line, especially spinning and weaving mills. Thus the line furnishes an example, noteworthy in every respect, of electric traction.

For operating electrically, freight traffic, through traffic of travellers, and local traffic were separated from one another, and provision made to have the size of trains adaptable to the number of travellers.

For getting the supply of current, it was planned to utilize the great descent of the Adda between Ponte di Desco and Ponte di Ganda, near Morbegno, which amounts to 36 m. in 5 km., and was not employed otherwise. The tributary area comprises 2,550 sq. km. with at least 10 litres per sq. km. per sec. of water supply, so that at least 25 m^3. per sec. may be depended upon as a water supply. The Società per la Trazione had the design of the 4 m. wide intake-canal worked out by Engineer Vittorio Gianfranzeschi for 30 m. descent with 25 m^3. water supply, 1.7 per cent. grade of bed, and 10 m^2. section of water; the construction involved 1.9 km. in open country, 2.9 km. in tunnels and vaulted sections. The work delivered, measured at the turbines, amounts to 7,500 h.p., corresponding to 75 per cent. efficiency.

(*a.*) *Power House.*

The turbo-generator house, 51.1 m. long, 21.7 m. wide, and 15 m. high, has space in its lowest engine room for four turbo-generators. Connected to this room is a three-story extension which has on its ground floor the switchboard, a work shop, the office of the superintendent, closets, and in the upper stories dwellings. Thus far three turbo-generators have been installed; the Francis turbines delivered by Ganz & Co. have each 2,000 h.p. at 150 r.p.m.; a fourth of 3,000 or 4,000 h.p. as required has been provided for.

Each of the two penstocks, 68 m. long, 2.5 m. wide, and inclined at 45 deg., may be cut off by a separate gate, so that repairs can be made on one turbine without affecting the others. Likewise the forebays, located in front of the penstocks, for preventing floating objects from getting into the turbines may each be cut off individually. At flood times the head can be diminished 4 m. The turbines are so arranged that part of the head acts by pressure, part by suction, hence the draft tube is submerged at every stage of the water.

The wheel is placed on the extended shaft of the generator. Each turbo-generator unit therefore has but two bearings, provided with ring-lubrication and arranged for water-cooling.

Speed is regulated by means of adjustable "Fink" stationary blades, the setting of which may be done by hand and by a governor with intermediate regulating engine. For paralleling the generators, the blades can also be set from the switchboard by means of a chain-gear acting on the regulating engine. Because of the impurity of the water of the Adda the regulators are driven by oil at 10 atmos. pressure. Each turbine is connected with an oil pressure-pump that pumps the oil into a reservoir. A "Hartung" pendulum governor actuates a distributing valve, which connects the pair of cylinders of the regulating engine either with the oil reservoir or the suction tank of the oil pump. Thus every change in speed of the turbines causes a change also in pressure in the cylinders of the regulator-engine, thus a change in setting of the guide-blades and in the water supply of the turbines.

The three-phase generators were built by Schuckert & Co. They deliver directly 15 cycle three-phase current at 20,000 volts at full load and phase displacement cos $\phi = 0.7$; each can deliver 1,050 k.w. at 1,560 h.p., actual, on the turbines. At this normal load the winding rises only about 45 deg. C. above the engine room in temperature. Change from no load to 1,500 h.p. causes the voltage to fall but 15 per cent. when speed remains constant. Suddenly removing full-load causes it to increase only 10 per cent. to no load. Short-circuit current is six times the normal. The generators are so designed that they can stand this short-circuited current two minutes without injury. For the space of one-half hour they can also deliver current at 30,000 V. The direct-connected exciters are fitted with an automatic switch that throws a resistance into the exciter circuit to prevent injurious rise in voltage on the line in case the turbine regulators do not act. This precaution was taken to prevent destruction of the switchboard appliances, by rise in voltage, and the result has been achieved of having the voltage not increase beyond 25,000 volts even if the speed goes to 250 r.p.m. The weight of a generator is 69.3 tons, of which 43.8 tons goes to the revolving parts, including shaft. The switchboard is arranged for four generators and two feeder lines. At present only one feeder-line is in use for the electric railroad, as soon as the projected extension of the road from Lecco to Milan has been built, the second is also to be provided. Behind the switchboard are the two groups of busses, to which well insulated underground cables lead from each generator. All appliances on the face of the board are for low voltage, so that the attendants will not come into contact with the high tension current. The generators are protected from overloads by fuses in porcelain tubes. Each of the two feeders has three ammeters, one for each phase, a wattmeter, a voltmeter and a three-phase switch. All handles of the three-phase switches for the high tension of 20,000 volts are arranged in front of the switchboard and fitted with a completely insulated connection. Only the handles of the two switches for the external circuit must be operated in the switch room itself. The feeder lines are fastened, where they leave the building, on an iron support, on which the lightning arresters are also. To assist these arresters, and to provide an uninterrupted outlet for static discharges, there has been installed in addition a simple water spray, which consists of three jets rising out of a grounded horizontal iron pipe through three adjustable tubes and being then caught up in three square zinc boxes connected with the three phases of the line. The energy consumed in the waterspray is relatively slight, since the 15 mm. jet, adjustable as to length, offers a high resistance to the generated current, while it acts as a good conductor for electrostatic discharges. The jets allow about 0.1 amperes to pass at 20,000 volts. The water consumed by the three jets amounts to 2.5 l. per sec. The spraying has proved remarkably successful in practice.

All measuring instruments have low voltage and are connected with the secondary windings of special transformers, stepping down the voltage from 20,000 to 55 volts. The switches for both feeder lines have their handles in the switch room, and have vertically moving blades with horn-shaped arc rupturing terminals. The switch for each phase is in a marble compartment.

(*b.*) *Feeder-line.*

The feeder-line consists of three bare copper wires, mounted on porcelain petticoat-insulators on 25/30 c.m. larchwood pins. Between Morbegno and Castione, near Sondrio, between Colico and Abbadia and Colico and kilometers 20,555 (between Samolaco and Chiavenna) the wires are of 7 mm. diameter, on the remaining parts 8 mm. The end transformer station is 5 km. from the end of the service-line at Sondrio; likewise the end transformer station is 5 km. from Chiavenna and 7 km. from Lecco. The sections fed by the several transformer stations have the following lengths:

	Kilometers.
Lecco to Abbadia	7,000
Abbadia to Lierna	8,200
Lierna to Bellano	9,700
Bellano to Dorio	7,700
Dorio to Colico	6,300
Colico to Cosio Traone	11,900
Cosio to Ardenno Masino	10,900
Ardenno to Castione	12,200
Castione to Sondrio	5,680
Colico, on the line to Chiavenna	20,555

The whole length of the feeder line is 90 km. The insulators of the feeder line are tested with 40,000 volts. Along open stretches the feeders are mostly placed on the outer side of the poles of the trolley wires, one above the other 600 mm. apart.

Of the nine substations five are between Colico and Abbadia, one at km. 20,359 outside of Chiavenna, three between Colico and Sondrio at Cosio-Traona, Ardenno and Castrone. The masonry buildings have two rooms. In one room the primary and secondary switches and the ventilating fan are located; in the other room are the transformers and the horn-shaped and Wurtz lightning-arresters. The leading in and out of the feeder and working lines is through window-like openings under the projecting roof. The transformer room is closed, and can only be entered after throwing out the switch. Each station has a transformer of 300 k.w. capacity at the secondary terminals; only the station at Abbadia has two transformers. The ratio of transformation is 6:1, a few turns are added which deliver current at 14 volts for the ventilating fan. For a short period the transformers will stand five times the usual load; they step down the voltage to 300 volts for the line. The weight of a transformer is seven tons. Along the entire feeder line, "horn arresters" are located which are attached to the earth-resistances on the poles. Since the step-down transformers are all in parallel, several take up the load of traffic on a section.

(*c.*) *The Line.*

The line conductors consist of two copper wires of 8 mm. diameter, suspended 6 m.

*Translated from the *Organ für die Fortschritte des Eisenbahnwesens*, November, 1904.

above the rails in the open, and 4.8 m. in tunnels. There are no solder-joints on the line; the wire-ends are pulled through connectors and fastened with pins. The same is true of the connection to the insulating section-breakers and turn-outs. For each trolley wire separate insulating suspensions are provided, fastened to two individual span-wires. On straight pieces poles with a bracket are usually provided to carry the span wires. On curves poles are used on both sides braced apart by two rods; at stations poles are provided with two brackets, right and left. The insulating "Ambroin" hangers are hung from heavily tinned 5 mm. steel wire supported at both ends by strain insulators. The shank of the *Ambroin* insulator has a disc-shaped extension on each side at its lower end for receiving the clips, and into which circular depressions in the clips fit. The clips are pressed together with bolts to hold the wire. The suspension is flexible and reduces the wear on the line due to fast trains. At the stations the conductors are so arranged that the train cannot pull in if its signal shows "stop." This is accomplished by having sections each some 300 meters long at the stations, which are usually kept dead by means of two insulating joints, and can only be put in circuit from the station when the signals show "clear." The succeeding sections are not affected by cutting out these safety sections, because they are connected around the station beyond the dead section. From this loop a connection branches off through which the station sections can be supplied with current by means of a switch. Thus when the station is disconnected, it becomes dead without affecting the adjacent sections.

The line conductors are provided with "horn" lighting arresters connected up to earth resistance, like the feeder lines. The arresters are mounted directly on the trolley-poles.

At turnouts (or sidings) the circuit is interrupted by connecting in four pieces of wood, soaked in "tar-oil" (creosote?) so as to prevent the crossing of wires carrying different phases at their intersecting points. Besides, at the turnout itself the outer wires are hung so much lower that the trolley wheel touches them only. Between these wooden pieces a vertical, gondola-shaped guide is inserted which depresses one side of the trolley-roller when it runs into the crossing. On the single-track portion the two outer wires end at the next pole. In running by the turnout, if the current is not cut off altogether the motors operate as single-phase.

The spacing of the poles on straight pieces is 40 meters; on curves it is gradually reduced to 26 meters for 300 meters radius. In tunnels the spacing of the suports is 34 meters on tangents, running down to 26 meters on curves. The distance between the two line wires is 870 mm. The service-rails, which are used as a return, are bonded at joints with copper bonds of 6 mm., fastened into holes in the rails by means of tapered shells. Besides, the rails are cross-bonded every 500 meters with copper crossovers.

(d)—Mode of Propulsion.

The express and passenger trains were at first propelled by motor-cars, the freight trains by electric locomotives. But the plan was shortly adopted of running the express and passenger trains up to 250 tons at 60 to 70 km. per hour and the freight trains up to 400 tons at 30 to 35 km. per hour on 1.0 per cent. grades.

1. *Motor Cars.*—The construction of the cars (19.14 meters long) is identical with that usual for four-axle pin-bearing truck (i. e., revolving truck) cars, except that the trucks, each of which has to carry two motors, are made stronger and have heavier king-pins. The weight of the motor cars, including electric equipment, is 53 tons. They can move five to seven ordinary two-axle passenger cars of 10 to 12 tons at a speed of 65 km. per hour on a 1.0 per cent. grade. Of the 10 motor cars, five are fitted out as palace cars, with rich interior furnishings, for express trains; the other five are fitted with day-coaches with 1st and 3d class compartments. There is a motorman's compartment at each end. Each car has a baggage-room and a little housing for the air-pump with automatic switch (in and out) and air reservoir.

The electric equipment of the cars is divisible into 3 groups: (a) equipment for taking off, conducting, distributing, admitting and cutting off the working current, trolley, car-wiring and main switch. (b) motors, controllers, resistances and air-pump. (c) equipment for lighting, heating and ventilating.

The trolley consists of a rod of non-conducting material, and carries two rollers of electrolytic copper 650 mm. long, 80 mm. in diameter, insulated from one another and running in insulated ball-bearings. Thus the current cannot pass out through the balls, but is taken off by carbon contacts mounted at both ends of the trolley-roller and conducted into the car by insulated cables. The trolley-roller support is borne on a framework of tubing, hinged at its lower end to two trolley stands, which are fastened onto the roof of the car through porcelain insulators. The mounting permits the ends of the trolley-roller to have enough independent motion to hug the trolley-wires, even if they do not both lie exactly in the same plane. The raising and lowering of the trolley is done by means of air pressure. At the same time, to prevent the trolley from striking into the overhead construction, a glycerine dashpot is provided, by which the motion of the trolley is retarded before touching the trolley-wires or the suspension. For each direction of motion a separate trolley is provided on the car.

The working current, at 3,000 v., is led to the car by flexible cables, where the high tension conductors are laid throughout in metal tubes well bonded electrically with the trucks of the car. A tap from the high tension wiring leads to an 8-kw. transformer; this delivers current at 100 v. for the air-pump motor, lighting, heating and ventilating fan. The main wiring terminates in the main switch boxes in the two motorman's cabs. The two feeds from the trolley-rollers can be disconnected from each other by taking out pieces located in a cast-iron box, which must be done when one trolley becomes useless and the trip has to be continued with the other one.

The main motor switch has six plug contacts, screwed into a disc that can be rotated about a vertical shaft. For each plug there is a corresponding metal socket, mounted in insulation; on pulling them out the springy plugs cause a slight rarefaction of the air to occur, which blows out the arc. The disc carrying the plugs can be rotated through 60 degrees by means of a switching-lever which projects out of the switch box, to reverse the direction of motion. This lever can be moved only when the switch is "dead." The main switch can be closed or opened manually with the switch handle or by means of the air-pump.

Parts carrying the high tension current are accessible only in the fuse box and main switch box. The motorman cannot touch these while the current is on, because the key for both boxes is in the valve chamber which is connected with the air-cylinder of the trolley and can only be taken out when the valve lever is so set that the trolley is lowered. It might happen that the motorman would open the main switch box, take out the key and let the trolley rise; to prevent the possibility of this being done also, the key can only be withdrawn from the lock when the door is shut and locked. Hence the doors of the switch and fuse boxes can be opened only when the current is off the car.

Each truck of the car has a high and a low voltage motor, of which the field magnet is bolted fast to the truck, while the armature is joined to the drivers by a jointed coupling. This coupling permits the wheel-axle to have free motion in every direction, up to a certain limit, with equal angular velocity of the pair of wheels. The armature is pressed on a hollow shaft having a clear space so large that the wheel-axle can move to respond to the play of the bearing-springs. The hollow shaft is supported by bearings in the end-plates of the field-magnets, so that all parts of the motor are supported by springs.

The high tension current gets into the field-magnets, but the armature winding is so calculated that the current there is *at* only 300 v. The starting, and the speed regulation are therefore accompanied only in the 300 v. circuit.

The speed of the three-phase motors is constant and depends on the frequency and on the number of poles in the machine. With two motors two speeds can be secured by connecting in "cascade," sending the current from the armature of one motor into the field-magnets of the other, whereby the speed is reduced by one-half.

The starting devices for each direction for each car are connected to one another by chains and wire cable.

The handle of the starting device (controller) has three positions. In the "stop" position the motors are cut out, the air-cock is not movable; in position for "slow speed" the motors are connected in "cascade";—in position for "high speed" only the high tension machines are in circuit.

During the time of starting, resistances are inserted in the armature circuit by means of three slip-rings. As the resistance is diminished, the motor speed approaches uniformity. The rheostat consists of a cast-iron box with cooling-ribs, in which are suspended three bundles of sheet-iron, toothed at the lower edge. Into this chamber a solution of soda is forced by compressed air. As long as the surface of the liquid does not touch the bundles of sheet-iron the armature circuits are open and the machines at rest. When the liquid touches the points the circuits are closed, the motor starts, and its speed increases with the wetted surface of the sheets. At the highest stage of the liquid the machine runs at full speed, when the armature circuits are automatically short-circuited. The short-circuiter is also worked by compressed air. To increase the cooling surface of the rheostats, they are, if need be, provided with cooling tubes. The raising of the level of the liquid in the rheostat is done by moving the air-cock of the controller.

The procedure in starting is as follows: First the switch handle of the controller is set at "slow speed," the air valve opened and the admission of air controlled with the small throttle valve; this first causes the main switch of the 3,000 v. circuit to be closed and the level of the liquid in the rheostat to rise slowly or quickly, according to the position of the throttle, until the motor short-circuits; the car is then running at "one-half speed." If change is to be made to "highest speed," the air valve must first be closed, which cuts off the line-current, then the switch handle is moved to "high speed," which disconnects the low voltage motor and connects the rheostat with the

armature of the high voltage machine; now air-valve and throttle are opened, whereupon the car is soon running at full speed. This manner of speed-control resembles the series-parallel control of D. C. motors. The start is just as economical as with them. The motorman, in starting, watches the ammeter and voltmeter placed right in front of him and is governed by them in controlling the acceleration with the throttle-valve. Switch and air-valve are so related that the manual operations can be carried out *only* in the order described; moreover, the air-valve can be moved only when the switch is put exactly in the position for "slow speed" or "high speed." In the cab are placed the box for the fuses and a switch for the air-pump motor. This has three positions. In the first position the cut-out switch and the automatic throw-over switch are in series; in the second in parallel, and in the third, both are out. If the automatic switch becomes inoperative, the motorman can connect the air-compressor by hand by this arrangement.

In the cab are also the valve of the Westinghouse brake, a hand-brake, an air-pump for manual operation, so that the trolley can be lifted if there is no pressure in the air-reservoir, and finally a valve for the air-whistle.

The air-pump, with its motor, the air-reservoir and the auto-switch are in a special housing. The auto-switch cuts the machine in or out, according as the pressure in the reservoir is 0.1 to 0.2 atmospheres lower or higher than the standard pressure of 6 atmospheres. The air-pump furnishes pressure for all electric devices, for the main switch, rheostat, trolley, signal whistle and also for the Westinghouse brake.

The 100 v. circuit of the 8-kw. transformer goes to a little switchboard in the baggage room. From here the lines run out for lighting, heating, and ventilation. The conductor attends to the switches.

Ceiling lights and wall brackets serve for illumination, being provided with three-phase incandescent lamps and with ordinary incandescent for D. C. at 23 v. To light the car also when the trolley is down, a small storage is provided, its switch being included among those on the switchboard in the baggage room. The heaters consist of resistance wires wound on insulating supports; in the palace cars they are built into the front and partition walls, behind bronze grills; in the day coaches they are distributed under the seats.

The palace cars are ventilated by slowly revolving two-bladed propeller fans electrically driven.

2. *Locomotives.*—The 4-axled locomotive, 10.306 meters long, consists of two trucks, flexibly joined, and shut off at the top and sides by folded leather strips. Each of the four axles has on it a high tension motor of 150 h.p. continuous capacity. The construction and coupling are similar to that used on the car-motors. The controlling devices are located in a cast-iron box. If, as is the case here, the locomotive is built for only one speed, the individual motors may be thrown in or out, according to the drawbar-pull required, which can be observed at the ammeter. In the interior of the locomotive are placed the air-pump with its transformer, which also deliver the current for lighting, the automatic switch for the pump, a hand air-pump, the valve of the Westinghouse brake and hand-brake. In the shallow extension of the locomotive cab the resistances are placed.

The weight of the locomotive amounts to 46 tons. It can ordinarily develop 5,000 kg., and as a maximum, 8,000 kg. drawbar-pull at 30 km. per hr. speed, and hence can move 450 tons of load on a 1 per cent. grade.

While switching at stations both trolleys are put up, for at low speed that which is to the front in the direction of travel may also be used without trouble.

(To be continued.)

An Automatic Ticket Machine.

The Lancashire & Yorkshire Railway has recently installed at Chapel Street Station, Southport, England, an automatic ticket issuing machine. At present only penny (2c.) tickets to St. Luke's Station are handled in this way, but if the experiment is successful other stations will be included. It is hoped by this means not only to save labor at the ordinary ticket office, but also to increase the suburban traffic, and so make a better fight against electric competition.

Automatic Ticket Machine.

The New York Central's Long-Distance Telephone Line.

The New York Central & Hudson River and the Lake Shore & Michigan Southern roads now have in use a telephone line of their own from New York to Chicago, over 950 miles, with a branch to Youngstown which is extended by the Pittsburg & Lake Erie to Pittsburg. This extensive plant, as has been told in the *Railroad Gazette* before, is owned by the railroad companies and is operated under contracts with the American Telephone & Telegraph Company and the local telephone companies in the several cities where railroad exchanges ("private branch exchanges") are established.

The line is No. 8 B. W. G (435 lbs. per mile) hard drawn copper, transposed every half mile. The circuit is in cable from the Grand Central Station, New York, to Weehawken, N. J., a distance of about three miles (including the crossing of the Hudson River). It is aerial thence to Buffalo, along the West Shore Railroad except for a few short submarine crossings and about one mile of underground cable in the West Point tunnel. The length of this circuit is 430 miles. Switching facilities are provided at Ravena; from Ravena north to Albany, a distance of 13 miles, is a trunk circuit of No. 9 B. & S. (208 lbs.) copper. Testing facilities have been established at Weehawken, Ravena, Syracuse and Buffalo.

The circuit from Buffalo to Chicago, a distance of 540 miles, including loops, is aerial except for a few submarine crossings on the Lake Shore. There are switching arrangements at Buffalo, Ashtabula, Cleveland, Toledo, Elkhart and Chicago; there are testing facilities at Ashtabula, Toledo, Elkhart and Chicago. There is a trunk line at Buffalo connecting the private branch exchange of the New York Central & Hudson River with that of the Lake Shore & Michigan Southern; at Cleveland there is a private branch exchange at the Lake Shore station and one at the company's general office building, the two being connected by trunk lines. Between Ashtabula and Youngstown, a distance of 63 miles, there is a branch trunk line, similar in construction to the main trunk line; this circuit extends 68 miles further to Pittsburg on the Pittsburg & Lake Erie. There are private branch exchanges at Youngstown and Pittsburg. At Chicago the circuit terminates in the private branch exchange of the Lake Shore & Michigan Southern, in the La Salle Street Station.

The cables at the submarine crossings and at the West Point Tunnel are of the type used in telephone plants—twisted pairs, paper insulation and No. 14 B. & S. gage copper conductors. There are several stretches where the congested wire conditions made it advisable to use insulated line wire; and here No. 11 B. W. G. was employed. The circuit is cut into test offices at intervals varying from 25 to 50 miles; at these points the circuit is carried to the buildings in insulated wire and connected to special test boards. In normal operation no apparatus is connected to the circuit at these test offices.

On the West Shore route, from Weehawken to Buffalo, the telephone line was placed on the top cross-arm, at the expense of moving two existing wires to a lower cross-arm, to make room. On account of the greater strength of the telephone line wires they are usually the last to break in high winds or sleet storms and will therefore be in trouble less if placed above wires of less tensile strength.

Private branch exchanges, by which term is meant a telephone exchange equipped by the telephone company but operated by the railroad company, have been established as follows: At New York City, 4; at Albany, 1; at Syracuse, 2; at Buffalo, 5; at Ashtabula, 1; at Cleveland, 3; at Toledo, 1; at Elkhart, 1; at Chicago, 2; at Youngstown, 1, and at Pittsburg, 1. Each railroad company owns the trunk line along its own railroad.

The American Telephone & Telegraph Company now has contracts with railroads operating long distance telephone lines on 5,400 miles of railroad. The length of telephone circuits is about 6,000 miles. These wires are on the lines of 14 different railroad companies and the mileage named does not include short trunk lines in and near cities and yards. Practically all of these lines are metallic circuit; that is, are made up of two wires, the positions of which on the poles, relative to each other, are transposed every half mile. The wires are hard

drawn copper, of weights ranging from 166 lbs. to 435 lbs. per mile of wire. The conductor weight per mile, aside from mechanical considerations, is a question of transmission efficiency; with a given talking efficiency the conductor weight increases with the length of the line. Mechanically, a copper wire weighing less than 150 lbs. per mile is usually unsatisfactory, because of insufficient tensile strength to meet all conditions. The limit of distance with a conductor weighing 166 lbs. is about 500 miles; the limit with a 435-lb. conductor is about 1,200 miles; these figures presume no cable or switchboards in the circuit—merely a standard telephone set at each end of the line. The existence of cable of any considerable length impairs transmission and the losses must be compensated for by larger line conductors. For very long lines it is economy to use larger sizes of conductors in cables than for short lines. The most economical cable from a telephone standpoint is one having dry paper insulation, with the two conductors of a circuit twisted together and the pairs arranged in reversed spiral layers and encased in a lead sheath.

Following are the names of the companies which have long distance metallic circuit trunk lines: Illinois Central; Chicago, Burlington & Quincy; Pennsylvania; Lehigh Valley; Delaware, Lackawanna & Western; New York, New Haven & Hartford.

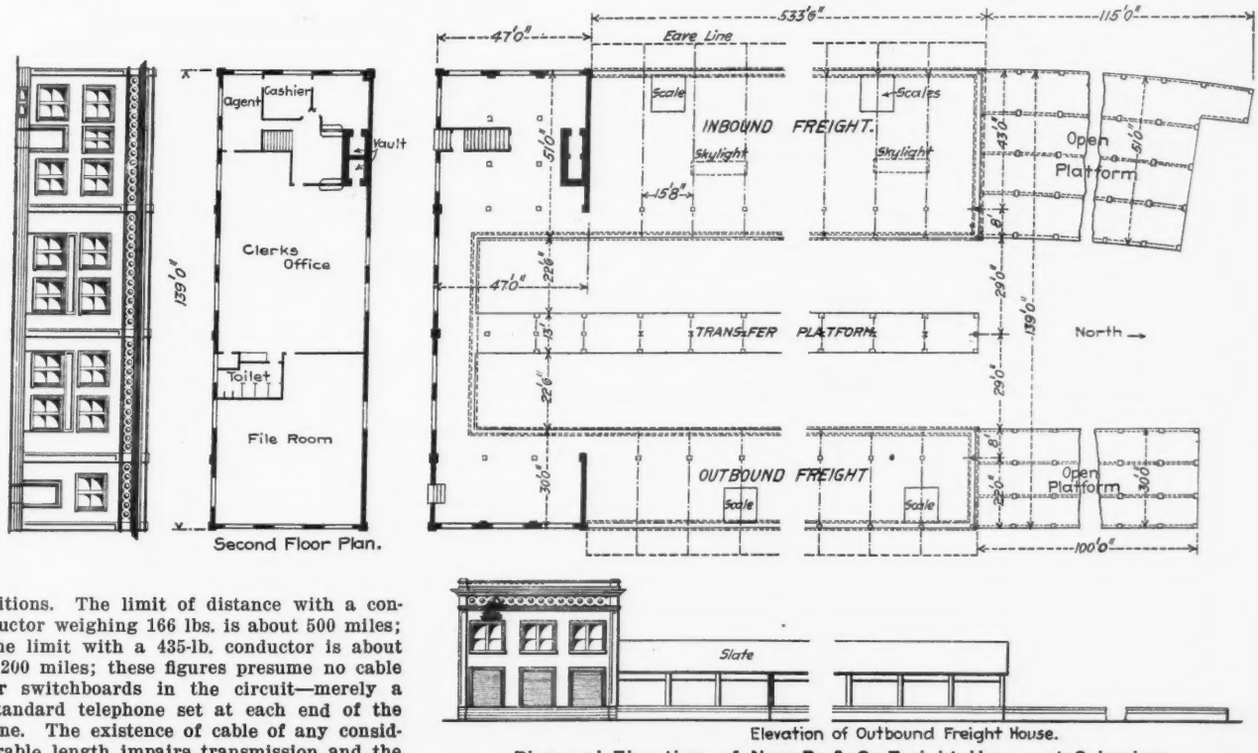
The Illinois Central's telephone line extends from Chicago to New Orleans; the Chicago, Burlington & Quincy's from Chicago to Burlington, Iowa; the Pennsylvania's from New York to Pittsburg and from Philadelphia to Washington; the Lehigh Valley's from Jersey City to Sayre, Pa.; the Delaware, Lackawanna & Western's from Hoboken, N. J., to Elmira, N. Y., and the N. Y., N. H. & H. from New York to Boston.

New B. & O. Freight House at Columbus.

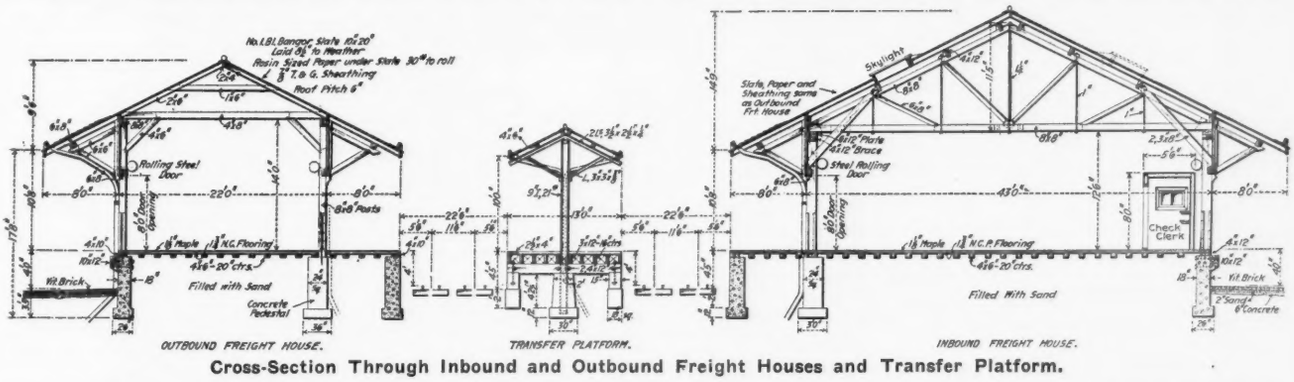
The Baltimore & Ohio has recently completed the rebuilding of the freight terminals for its Newark Division at Columbus, Ohio. These include a new teaming yard and a large new inbound and outbound freight house and office building. The general arrangement of the freight houses and office is shown in one of the accompanying drawings. The inbound and outbound houses are 533 ft. 6 in. long and are parallel to each other, being separated by four unloading tracks and a covered transfer platform which is of the same length. The office building containing the division freight offices is a two-story brick building, 47 ft. deep and is laid on 4-in. x 6-in. sleepers bedded in sand filling put in between the side walls up to the proper level. The sides of the building are enclosed with steel rolling doors between each pair of posts, giving clear openings 8 ft. high by 15 ft. wide. On the track side a platform 8 ft. wide extends the entire length of the building and is covered by the roof overhang. The center line of the unloading track is 5 ft. 6 in. out from the edge of this platform. The roof of the freight house is supported on wooden trusses of long leaf Georgia pine and is covered with slate. Skylights 4 ft. x 16 ft. are inserted above every third bay to provide top light when the rolling doors are down. Six scale platforms are provided and two small booths for the check clerks.

The outbound house is the same length as the inbound house, but is only 22 ft. wide. It is built in the same manner as the inbound house with rolling steel shutters in each bay on both the street and track sides. Eleven scale platforms are provided. The transfer platform is 13 ft. wide and is built on concrete piers. The floor is 2½-in. x 4-in. Georgia pine laid on 3-in. x 12-in. joists which rest in turn on 4-in. x 12-in. floor beams on top of the piers. An umbrella shed covers the entire length and width of the platform. It is supported by 9-in., 21-lb. I-beam central columns spaced 15 ft. 8 in. centers, extending across the entire width of the two freight houses at the south end. At the north end an open platform the width of each of the freight houses extends out 100 ft. beyond the buildings.

The inbound freight house is of frame construction 43 ft. wide out to out of posts and 12 ft. 6 in. from floor to bottom chord of roof girders. It is built on concrete wall and pier foundations and the floor is 4 ft. above the level of the roadway and tracks. The floor



Plan and Elevations of New B. & O. Freight House at Columbus.



Cross-Section Through Inbound and Outbound Freight Houses and Transfer Platform.

ter to center and extending down to the bottom of the concrete piers. The drainage from the roof is carried off from the gutters through down spouts brought in from each side to the supporting columns and connecting under the floor with the city sewer. The drawings show the other principal details of construction of the buildings.

New Railroad Laws in Texas.

The Texas Legislature at its session recently ended passed a number of bills affecting railroads. There were two railroad taxation bills passed and they have been approved by the Governor. The more important of these tax measures is that which provides for taxing the intangible assets of railroads, private car companies and interurban electric roads. Other corporations of a quasi-public character are embraced in the law. It is provided that the amount of intangible assets possessed by a railroad shall be arrived at by deducting from the market value of the company's stocks and bonds, the amount for which it renders its physical property for taxation. Inasmuch as some of the Texas railroads which were built before the stock and bond law went into effect are bonded for as much as $40,000 per mile and are now taxed at the rate of about $7,000 per mile, they will have to pay an increase of tax on about $30,000 per mile under the new law. A state tax board is created by the new law. The act becomes effective Jan. 1, 1906.

As a temporary measure, pending the going into effect of the intangible assets bill, the legislature passed another bill taxing railroads 1 per cent. on their gross freight and passenger receipts. This bill will become inoperative when the first mentioned law takes effect.

A law was passed prescribing the venue of suits against railroads so as to permit the filing of damage suits in any county through which the defendant railroad passes. Other acts are: One in the special interest of the Kansas City, Mexico & Orient Railroad authorizes the sale of state school lands to railroad companies for depot, terminal and town-site purposes.

The Southern Pacific merger bill authorizing the Galveston, Harrisburg & San Antonio to purchase and operate the Galveston, Houston & Northern; the Gulf, West Texas & Pacific; the New York, Texas & Mexican, and the San Antonio & Gulf roads. Before this consolidation can become effective the San Antonio & Gulf road must be extended from Stockdale to Cuero, Texas, 65 miles. The survey for this extension has been made.

A bill requiring railroads to provide all main line switches with derailing tracks and requiring that all such switches be provided with switchlights. One granting railroads an extension of two years time in which to complete their lines.

Two Santa Fe consolidation bills. One authorizes the Gulf, Colorado & Santa Fe to purchase and operate the Cane Belt Railroad; the other authorizes the same company to purchase and operate the Jasper & Eastern. One authorizing the Texas & New Orleans to sell its Dallas-Sabine Division, Dallas to Sabine Pass, 360 miles. The sale must be to an independent company not in any way connected with the Southern Pacific.

A bill which restricts the defense of assumed risk and contributory negligence as to railroad and street railway corporations.

A law authorizing the formation of corporations to construct, own and operate causeways across lagoons and bays. The primary object of this law is to enable the several railroads which enter Galveston to form a company to build a causeway across Galveston Bay to connect the mainland with Galveston Island.

A law giving the Railroad Commission authority to require a railroad company to construct sidings or spur tracks to private industries, and authorizing railroads to connect where their tracks are within one mile of each other, and to require them to connect, upon order of the Railroad Commission, where they are within one-half mile of each other.

A law under which terminal companies are given the same rights as railroad companies. It subjects terminal companies to the regulation of the Railroad Commission and to the stock and bond law. It is further provided that they shall have no one track more than 20 miles in length.

A bill requiring railroad companies to maintain water closets at all passenger stations; another requires railroad companies to fence their right of way in stock-law districts.

A special law in the interest of the Rock Island giving that company the right to use a certain part of the water front in the city of Galveston for terminal purposes, etc.

A large number of bills which would have done the railroads serious injury were defeated.

Commerce and Labor Export Bulletin.

The Bulletin of the Department of Commerce and Labor for February, 1905, corrected to March 9, shows exports of bread stuffs during the month of February of a value of $10,604,537, and this compares with $12,440,131 for the month of January. The total for the eight months from June 30, 1904, is $63,067,540, compared with $114,927,648 in 1904, $146,754,656 in 1903, $152,545,318 in 1902 and $173,992,044 in 1901. Mineral oils to the value of $670,800,378 were exported in 1905, compared with $635,476,918 in 1904. The value of cotton exports decreased from $62,922,658 in October, 1904, to $59,740,704 in November, $48,856,545 in December, $30,469,421 in January, and $19,740,140 in February, 1905. The total cotton exports for the twelve months of 1904 were 6,555,041 bales (3,364,419,627 lbs.), valued at $368,456,113.

The exports of principal articles of bread stuffs, in bushels, from the principal customs districts, including about 97 per cent. of the total exports, were as follows: Barley—February, 1905, 602,121; February, 1904, 289,709; eight months ending February, 1905, 7,523,499; for the same period in 1904, 8,754,731. Corn—February, 1905, 14,190,124; 1904, 6,827,304; for the eight months ending February, 51,021,031 in 1905; 41,501,587 in 1904. Oats—February, 1905, 101,635; 1904, 35,328; eight months, 1905, 945,147; 1904, 637,483. Rye—February, 1905, 18; 1904, 81,395; eight months, 1905, 1,348; 1904, 753,408. Wheat—February, 1905, 122,157; 1904, 1,464,522; eight months, 1905, 4,196,022; 1904, 40,713,275; for the twelve months in 1904, 13,015,394; for the same period in 1903, 73.145,273. Wheat Flour (bbls.)—February, 1905, 550,678; 1904, 1,399,441; eight months, 1905, 5,812,359; 1904, 13,152,203. Total value of bread stuffs—February, 1905, $10,604,537; 1904, $11,024,975; eight months, 1905, $63,067,540; 1904, $114,927,648. The total exports of bread stuffs for February from the different ports were as follows: In 1904, Baltimore, $1,112,302; New York, $2,179,648; Galveston, $1,323,684; New Orleans, $1,349,142; for 1905, Baltimore, $920,463; New York, $2,410,401; Galveston, $711,956; New Orleans, $2,466,386.

Cattle, hogs and sheep to the value of $26,925,642 were exported for the eight months ending February, 1905, compared with $27,176,444 in 1904 and $17,366,204 in 1903. The exports of provisions for the eight-month period decreased from $107,732,255 in 1904 to $97,058,848 in 1905. The total exports of provisions, including cattle, hogs and sheep, for February, 1905, were valued at $16,433,483, compared with $16,125,089 in 1904; for the twelve months in 1904, $190,282,133, compared with $199,472,565 in 1903; for the eight months ending February, 1905, $123,984,490, compared with $134,908,699 in 1904.

The Egyptian State Railroads.

The London *Times* of March 11 summarizes the recent report of the Commission on the Egyptian State Railroads which inquired (1) into the administration; (2) into the manner in which the capital sum at the disposal of the Government may be most advantageously applied; (3) as to the advisability of broadening the gage from Luxor to Assuan; and (4) whether the arrangement by which the administration of the railroads has been combined with that of the Port of Alexandria should now be modified by any suggestions for improving the commercial facilities of the port.

The report points out that it has not been possible to work the railroads on good commercial lines; and the Commissioners recommend that the same percentage should be adopted for old and new capital on the State railroads, and suggest 5 per cent. as a fair figure, which, taking the net revenue of 1903, viz., $5,170,034 as the basis, would put the present value of the lines open at about $103,396,500. Following on this change the Commission think that one chief for the whole State railroad system should be appointed, to be responsible for the State railroads and telegraphs to a State council. This state council should be formed of at least five members who might take general cognizance of all other transport agencies in the country. The functions of the council should not be to interfere directly with the executive, but to sanction expenditure and to receive reports of the results of such expenditure.

The Commission recommend the construction of new lines from Salihiyeh to Kantara, Defrah to Santah, Zifteh to Zagazig, and Ashmun to Barrage, entailing a total expenditure of $3,402,000. The report does not recommend the broadening of the present 3 ft. 6 in. gage from Luxor to Assuan, but thinks that the gap of 200 miles between Assuan and Wady Halfa must sooner or later be bridged, and the Commission have little doubt that it would pay better to link up the two systems by spending $4,860,000 than by spending $2,916,000 on widening the existing Luxor-Assuan line, and that the project of uniting the two systems, the Egyptian of 1,667 miles and the Sudanese of 700 miles, is most worthy of immediate attention and study as being quite likely to give a return on the capital in a comparatively short time.

The Commission find that the administration of the port of Alexandria should be separated from that of the railroads. From the figures laid before the Commission, they find it absolutely necessary to extend the shipping facilities of Egypt in some way or other if the railroads are not to continue in a state of chronic blockade; but it is impossible for them to decide whether this could be done at once by employing more lighters at Alexandria, by extension of quays, or by the opening of other ports.

The capital expenditure necessary to improve the existing system and provide the necessary rolling stock is: (a) For rolling stock, permanent way, sidings, signals, fencings, and double-tracking certain lines, $10,807,425; (b) construction of the new lines mentioned above, $3,402,000. Total, $14,209,425.

GENERAL NEWS SECTION

NOTES.

Suits to recover penalties for violation of the Safety Appliance law have been begun against the Wisconsin Central, the Seaboard Air Line and the Atlantic Coast Line.

A press despatch from Austin, Texas, April 24, says that the Railroad Commission of that state has decided to make a reduction of 5 cents per 100 lbs. on the rates on cotton to Houston and Galveston from distances within 165 miles.

Governor Folk, of Missouri, has approved a law which has just been passed requiring railroads at intersections to make reasonable daily connections with each other, when so required by the railroad commissioners.

The Missouri Legislature has passed a law regulating demurrage and the use of freight cars which appears to be similar to that passed in Oklahoma. The report that the Missouri law was not approved by the Governor is declared to be erroneous, the bill (No. 179) having been signed by Governor Folk on April 12.

Governor Folk, of Missouri, has signed the Speer maximum rate law and in so doing has made a statement to the effect that if the law is inequitable the railroad commissioners or the next legislature must correct the inequalities. He regards the measure as "at least a step in the right direction." The live stock tariff, tacked on in the Senate, is so low that some of the cattle rates are below cost. For example, it would cost $6 to ship a standard car of 20,000 lbs. from Hannibal to St. Louis. To ship cement, a Hannibal commodity, the same distance, would cost twenty dollars for a standard car of 40,000 lbs. The present rate on cattle is sixteen dollars, and on cement is sixteen dollars, so that the rate on cement is actually raised, while that on live-stock is reduced more than 50 per cent.

The Legislature of Tennessee has passed a law forbidding the sale, or offering for sale, of non-transferable tickets by any person other than the authorized agent of the common carrier issuing the same. There is a section requiring the railroad to redeem unused tickets, or parts of tickets. Violation of the law is a misdemeanor, punishable by a fine of $50 to $100.

The Attorney-General has advised the Secretary of the Interior that the action of the Interior Department in securing reduced rates from railroads carrying freight for contractors on Government irrigation works in the far West is in no sense illegal. He says that where the United States receives the whole of the concession and contractors none, then neither the spirit nor the letter of the act to regulate commerce has been violated.

The Minnesota Legislature at its recent session passed a law forbidding the changing of freight rates or classifications without the consent of the Railroad Commission. The same act gives the Commission control over terminal and switching charges. Another act prescribes penalties for giving or receiving rebates. A joint resolution was passed declaring that the distance rates in the local tariffs in the state are too high and directing the Railroad Commission to secure an adjustment, with a view to securing greater uniformity of rates and a uniform scale of percentages which each class rate shall bear to the first class. A bill was passed authorizing the Railroad Commission to prosecute complaints of Minnesota citizens before the Interstate Commerce Commission. An elaborate bill to require railroads to pay penalties for not furnishing cars when ordered, was voted down.

The Secretary of War, in a letter to a business man of Cincinnati, says that in the management of the Panama Railroad the United States Government will act without regard to transcontinental railroad rates; that the monopoly now enjoyed by the Panama Steamship Company in the transporation of freight and passengers between Panama and San Francisco will be terminated July 1, when the company's present contract expires, and that thereafter nothing will interfere with open competition in transportation between those points. He declares that the Government will maintain the present line of three steamships between Colon and New York, in order to prevent any possible combination which might seriously enhance the cost of transporting material for the canal between those points. The policy of the Government will be to charge such rates as will pay for the carriage of the goods a reasonable return on the investment of the government and nothing more. The proposed changes will not have much influence on transcontinental rates, because but a small proportion of that which goes to make up transcontinental freight can be carried by the isthmus. The long trip and the fact that the merchandise carried is to be a considerable period in the tropics exclude the possibility of carrying many kinds.

Technical Advertisers Organize.

The advertising representatives of a large number of concerns engaged in the manufacture of machinery and allied industries have formed an organization to be known as the Technical Publicity Association. The first annual meeting, dinner and election of officers was held in the rooms of the Hardware Club in the Postal Telegraph Building, New York City, on the evening of April 27th. An address was delivered by Mr. E. T. Harris, well-known as a broker of trade and technical journals.

British Officials' Trip to America.

A party of Great Central Railway officials, consisting of Mr. J. Rostern, Assistant to the General Manager; Mr. E. A. Clear, Assistant Goods Manager; Mr. W. Clow, Assistant Superintendent of the Line, and Mr. J. Rowlandson, Engineer's Assistant, left Liverpool on April 4 for the United States. The object of the journey, in addition to attending the International Railway Congress, is to visit the leading American railroad centers, and inspect track and signaling methods. After landing at St. John, the party proceeded to Montreal, traveling from there to Boston, Buffalo, Cleveland, Chicago, St. Paul, St. Louis; Cincinnati, Pittsburg, Altoona and Washington, where they will stay for the Congress, after which they will visit Baltimore and Philadelphia.

Electrification of London Underground Lines.

After several satisfactory trial trips, the Metropolitan Company has decided that no further experimental runs will be needed on its portion of the Circle. Everything is completed and in working trim. As soon as the District Ry. is ready, the Metropolitan will begin running electric trains around the Circle, all the necessary rolling stock being available and awaiting use at Neasden Works. Meanwhile the rolling stock has been thoroughly tested by use under ordinary conditions of running on the Baker Street to Harrow line. On this section of the Metropolitan system there is now in daily operation an all day service of electric trains. If it is not possible to run right around the Circle, owing to the backward state of the District's electrification work, the Metropolitan will probably put on a service of electric trains on its portion of the Circle. The Metropolitan's electrification contract, which is the first to be finished, was let to the British Westinghouse Company.

British Locomotive Trade.

The report of Beyer, Peacock & Co., Ltd. (the Manchester locomotive builders), for 1904 states that the profit on trading for the year amounted to $89,895. The amount brought forward last year was $98,900, from which must be deducted, after allowing for interest on the debenture stock, reserve for depreciation and provision for income tax, the net loss on revenue of $19,335, leaving a balance of $79,560. The preference dividend has been paid, absorbing $82,500, and leaving a deficit of $2,940. The workshops have been full during the year and deliveries satisfactory. The explanation of the falling off in the profit and loss account is that given at the last general meeting of the company, namely, general depression in trade, and that the increased demand produces keener competition. So keen, indeed, was it during 1904 that prices fell to a non-remunerative level. The company, however, have turned out 14 more engines than during the previous year—more engines, in fact, than have been turned out in a single year for the past seven years.

Locomotive Smoke in London.

Proceedings against railroad companies in respect of nuisance caused by the emission of smoke from locomotives have largely increased of late years in the County of London, as the report of the Public Control Committee of the London County Council shows. The number of convictions has advanced from 37 in 1900 to 75 in 1901, 198 in 1902, 232 in 1903, and 280 in 1904. During these five years not a single conviction has been registered against the Great Western, London & South Western, or Metropolitan companies, and the framers of the report argue in consequence that it is quite possible for all the companies to comply with the law. Prior to the year 1898 smoke nuisance was not experienced in London to a serious extent as Welsh smokeless coal was mainly used by the companies; but the coal strike in South Wales in that year compelled them for a long time to use bituminous coal; the latter being cheaper, some of the companies, it is suggested, were afterwards reluctant to return to the use of the more costly coal. The committee thinks that in order to deal effectually with the matter, the railroad companies should use only smokeless coal for the London traffic, as smoky bituminous coal cannot be used on locomotives running with frequent stoppages without at times causing nuisance.

Niagara-Welland Power Company.

A company chartered by this name with an authorized capital of $5,000,000, and plans which it is said have already been approved by the Canadian Minister of Railways and Canals, proposes to supply electric power in Canada throughout the eastern part of the Niagara Peninsula, taking water from the Niagara river several miles above the falls, and by means of the Welland river and a canal seven miles long, through St. Catharines, conveying the water finally to Lake Ontario. There will be a total fall of 210 ft., and from St. Catharines an "almost natural raceway" has been found. The announcement of this enterprise says naïvely that as the water will be taken from some distance above Niagara the grandeur of the falls will not be impaired!

The President of this company is Harry Symons, and Roderick J. Parke is Consulting Engineer. It is said that active preparations are being made to ask for bids for construction work very soon. It is proposed to run power transmission lines in all directions, aggregating over 200 miles in length. It is expected to supply power to electric railroads in St. Catharines, Merritton, Bradford, Woodstock, London, St. Thomas, Galt, Stratford, Guelph and other places.

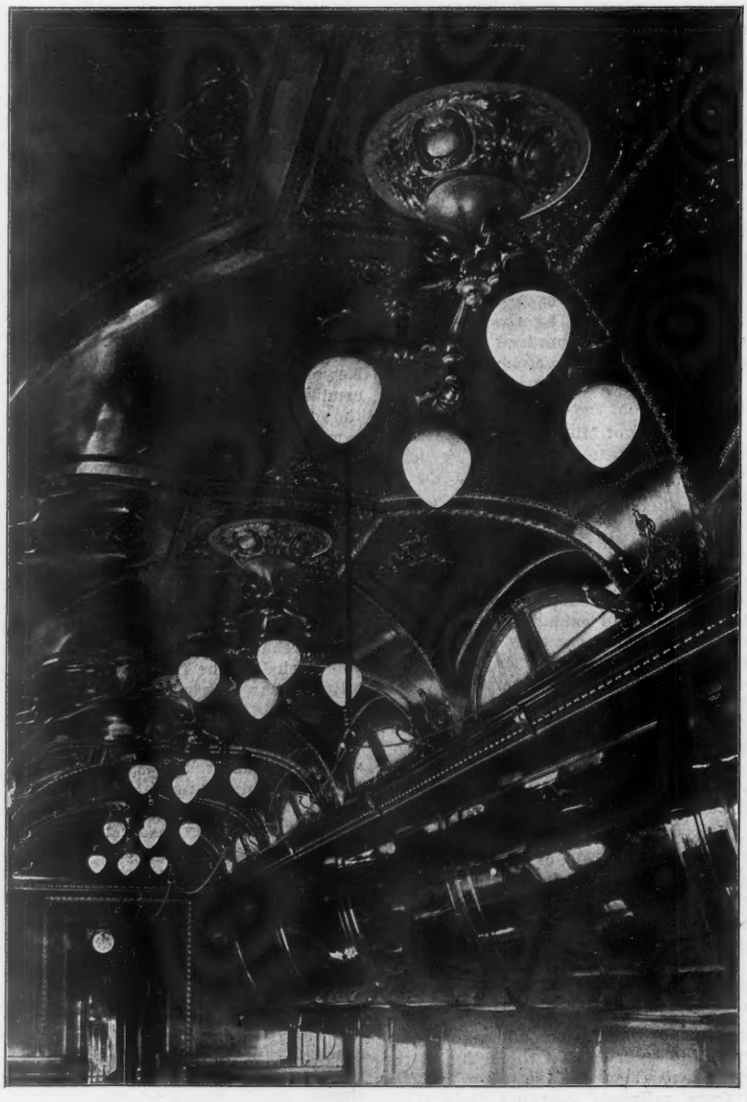
Railroads in Formosa.

A 40-mile section of the Formosan Government Railroad, from the Dakusui river north to Koroton, is building, and it is expected that it will shortly be put in operation. The entire line is eventually to run from Kilung, in the north, through the western portion of the island, to Takow, in the south, and will then afford transportation facilities between the principal ports and the developed portions of the island. Two sections of the line are now in operation, one in the northern and the other in the southern part of the island. The gage is 42-in., and the rails are of 60-lb. section. Building the road was begun soon after the occupation by the Japanese. The Chinese line then in operation between Kilung and Shinchiku was of so little value, on account of its winding route, sharp curves and heavy grades, that the Military Department surveyed a new route and built a new line between Kilung and Taihoku. In 1897 the road passed into the control of the Civil Department, and in 1899 the sum of $14,342,400 was voted by the Japanese Diet for the extension of the line to Takow. On the section now building, much difficulty has been encountered in the crossing of the Dakusui river. A temporary wooden bridge in three sections has been built, but it is probable that it will be swept away by the floods during the heavy rainfall of the summer. On account of the force of the current during the floods and the shifting of the channel, the engineers in charge have not yet been able to decide upon a satisfactory plan for building across the stream a permanent steel bridge 4,000 ft. long. Experimental piers are soon to be tested and, if satisfactory, will be used in building a permanent structure.

When the section now building, which is a northern extension of the southern division, is completed, there will still be a gap of nine miles between the northern and southern divisions of the road. On this section, eight tunnels aggregating 3¼ miles long, and three bridges 2,510 ft., 1,760 ft. and 200 ft. long are to be built. At present a double-track tramway line of 19½-in. gage connects the two divisions by a roundabout route, Chinese coolies furnishing the motive power. It is probable that within a few years a branch line will be built into the timber district near Mount Arizan, where there are extensive forests of hinoki (Chamæcyparis obtusa), which is used extensively for building purposes, and is at present imported from Japan. The chief products of the island that enter into the freight traffic are rice, coal, camphor and tea, which are produced in the north, and rice, potatoes and sugar, produced in the south. The freight tariff now in force varies from five to 8½ cents (gold) per ton per mile for less than car-load lots, and from two to five cents, for car-load lots. The passenger rates are three cents a mile for first class and 1½ cents a mile for third class, there being no second class. During the Japanese fiscal year ended March 31, 1904, there were 174 miles of road in operation and the equipment consisted of 30 locomotives, 310 freight cars and 75 passenger and mail cars. The gross earnings for this period were $481,165, of which $269,880 came from passengers, $208,989 from freight and $2,296 from other sources. Operating expenses were $406,641, leaving net earnings of $74,524. The engine mileage was 541,021 miles, and the car mileage (passenger and freight, all trains being mixed), 4,767,303 miles; 1,197,644 passengers were carried and 327,907 tons of freight hauled, about 90,000 tons of which were railroad materials and other government supplies from which no revenue was received. —*U. S. Consular Report.*

New Pintsch Light.

The Safety Car Heating & Lighting Company, New York, announces a noteworthy improvement in its Pintsch lighting system, already a standard for passenger car service. After two years of experimenting, a wonderfully brilliant lamp of special design has been evolved. The distinguishing feature of this lamp is a new and unique type of mantle. This is about one inch in diameter, and is inverted, being so arranged as to provide a suitable jet. In the accompanying illustration, the lamps are shown in service on a Pullman sleeping car. The mantle and globe are so arranged that they are fastened to the lamp proper by means of a screw socket similarly to an ordinary incandescent lamp. The satisfactory results obtained from this new lamp may be appreciated from the fact that it gives 33 candle power per foot of Pintsch gas used, or about three times the efficiency of the present standard Pintsch lamp, which has been so generally satisfactory. Actual service tests show that the life of the mantle is at least three months. The ease of renewing the mantles, the smokeless flame and the cleanliness of the lamp add to its very great advantages over any previous type. More than this it may be used in connection with the present Pintsch lighting equipment in use on the majority of cars



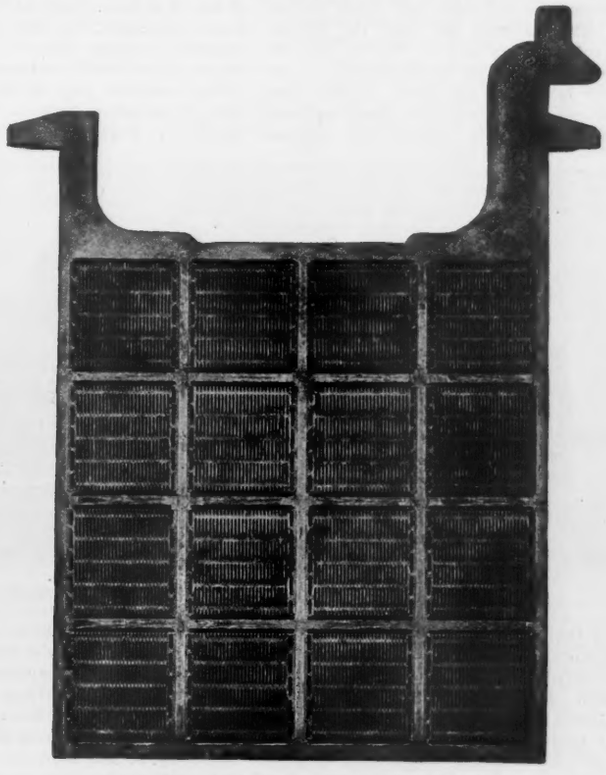
New Pintsch Light.

throughout the country, so that there is only the small additional cost of renewing the lamp fixtures. Thus the simplicity, efficiency and economy of the Pintsch system are retained along with the increased advantages of the new lamp.

The Bijur Storage Battery.

The accompanying illustrations show a new form of storage battery plate recently perfected by Mr. Joseph Bijur which, while it retains the same electro-chemical combination of lead and sulphuric acid as used in other storage batteries, differs from them in design and construction. The aim was to produce a battery plate which would be as nearly as possible mechanically and chemically perfect, and, therefore, one which would embody a rigid structure, freedom from tendency to distortion from expansion, perfect acid diffusion, high specific capacity, high rates of charge and discharge, high efficiency, good regulation, freedom from "sulphation" and buckling.

Portable Bijur Storage Battery for Train Lighting.



Bijur "High Duty" Storage Battery Plate.

The Bijur plates are composed of multiples of pure lead structures in the shape of gratings or "grills." These are welded into a stiff frame made of an alloy of lead and antimony and the weld is produced without the use of tin or solder flux. At each end of the grill a space is provided for its elongation by expansion, and provision is made for expansion sidewise. The result is a plate having the stiffness, strength and inoxidizable support of the alloy grid and rigidly held active parts, yet with provision for their expansion without the setting up of any strains that could produce buckling.

The grills are composed of a multitude of minute openings, or cells, open through from face to face. When in the untreated metallic state these grills are open structures, having a large number of component ribbons running in the vertical direction, supported by heavier cross members running horizontally, which serve as conductors and give lateral stiffness. During the formation process, part of the metallic lead is converted into oxide, which, by reason of the large increase in volume, nearly fills the openings. The ribbons on the positive elements have a large amount of metal left as a reserve for the oxidization which is attendant on the normal action of every storage battery.

When the oxide is formed in the rectangular cells, it assumes a slightly elliptical shape, which, expanding into the rectangular containing space, produces a positive locking-in. At the same time, even when the oxidization is carried to the point of apparently completely filling the cells, the tendency of the ellipse to grow larger along both its axes, insures the presence of a minute slot through the center of the oxide mass, which allows the flow of electrolyte to take place freely through it. The resultant oxidized plate, therefore, is rigid, the grills are firmly held, they expand without producing strains, each particle of oxide is firmly pressed against the lead from which it is formed, and the entire plate is open through and through to circulation and diffusion of the electrolyte. Owing to the character of the design and the structure of the oxide formed, the plates possess several features hitherto unattained in battery practice. Buckling cannot take place, and so far, repeated attempts to produce distortion have failed. Also, since the perfect diffusion through the plate prevents high acid concentration in the pores, deleterious sulphation does not take place even when an effort is made to produce it.

One of the important advantages gained by this form of design is that in a plate of given dimensions, 20 per cent. greater capacity can be obtained with about 10 per cent. more reserve lead, than in any form of plate hitherto constructed. The fine subdivision of the oxide into small masses, combined with the fact that the surfaces of the plates are composed of ribbons on edge, precludes the possibility of blistering or shrinkage that is liable to occur when plates contain oxides in large masses.

The makers claim that owing to the rapid acid diffusion, a full charge may be given to the batteries on a voltage of 2.4 to 2.5 volts instead of 2.7 volts as usually required. This low charging voltage results in an increase in efficiency and reduces the size of boosters required to charge. The structure of the plate forms a conducting network to all parts of the plate, insuring an equality of action all over its surface. This together with the fact that the gas can escape without dislodging active material, permits the battery to stand high rates of charge and overcharge without deterioration.

The General Storage Battery Company, 42 Broadway, New York, which is putting this new type of battery on the market under the name of the Bijur "high duty" battery, has recently equipped a factory at Boonton, N. J., for the production of the batteries on a commercial scale. Special automatic machinery for the cheap and rapid production of the grills and frames and the welding and forming of the plates has been installed, and the makers claim to be able to produce these batteries for a lower cost per kilowatt-hour capacity than other high grade batteries now in use. The company has also developed a new line of automatic regulating boosters, cell switches and other auxiliary apparatus for central station work.

The Alton's Strict Rules.

A press despatch from Chicago says that employees of the operating department of the Chicago & Alton have been given to understand that dismissal will be the penalty of their being seen in any questionable place, or detected in any questionable practice. The subject came up during a conference which the management recently had with a committee of conductors who complained of the discharge of some men who were caught taking a drink in a dance hall. A request to reinstate the men met with determined refusal, and the management took occasion to insist upon the employees leading a rigid moral life. Continuing, the account says: "The Alton's rules forbid a man engaged

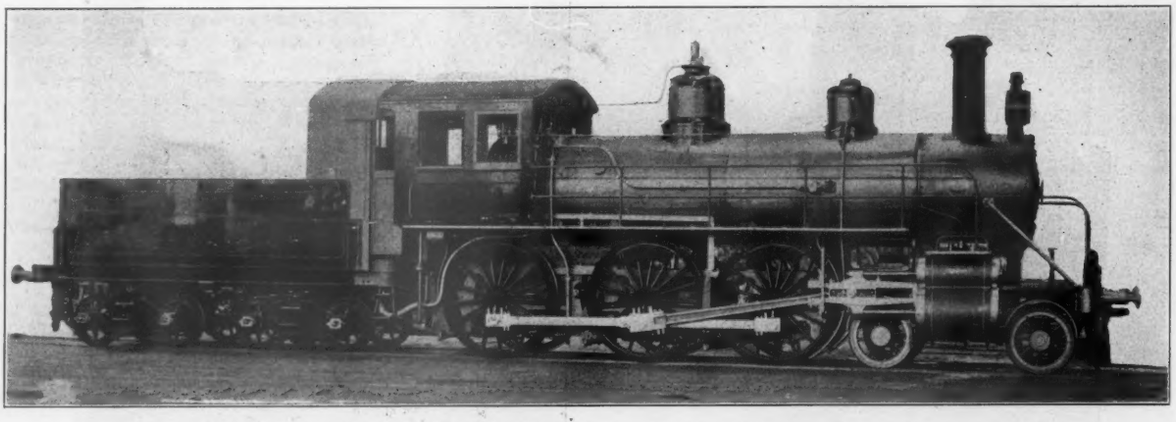
in the operation of trains to visit a race track, a dance hall, or any resort where liquor is sold, or where there is gambling or any immoral or questionable practice permitted. None of the officials in the operating department ever carry intoxicating liquors on their private cars when on Alton rails, nor do they enter saloons in towns along the Alton road."

From which it would appear that a brakeman who wishes to take a drink should get some place not "on Alton rails."

Locomotive for the Siberian Railway.

The Siberian Railway has been taxed to its utmost during the past year in the transportation of troops and supplies to the Far East. The locomotive shown in the accompanying illustration is of the type used for the passenger or fast military trains on the Siberian Railway. Most of the locomotives are either of Russian or United States build.

The gage is 5 ft., which is that of the whole Russian Empire, deliberately chosen to prevent the other nations at the frontier from using the railroads for their rolling stock if their armies get over the border. The European gage is 4 ft. 8½ in., but the Chinese is wider than the Russian 5 ft., so the latter is safe in any case. It will have been noticed that as the victorious Japanese advance they rapidly reduce the Russian gage to their 3-ft. 6-in. gage and use their rolling stock. A large clearance gage is also a very useful feature of the Russian imperial railroads. In the case of the locomotives this allows of a continuous platform from the cab round the boiler and over the bogie, fitted with railings for the protection of the crew, which in appearance quite reminds of shipboard.



Ten-Wheel Locomotive for the Siberian Railways.

It will be noticed that one of the locomotives is fitted with a very ample rear cab. This gives a striking idea of the terrible climate of snow and wind in which they have to work.

These locomotives were built by the Baldwin Locomotive Works, and are compounds on the well-known Vauclain system.

The following are the leading dimensions:

Gage	5 ft.
Cylinders	25x26 in.
Drivers	72 in.
Total wheelbase	26 ft. 3 in.
Drivinw wheelbase	14 ft.
Weight, (total) about	133,290 lbs.
Weight on drivers, about	91,990 "
Boiler, diameter	60 in.
No. of tubes	223
Diameter of tubes	2 in.
Length of tubes	14 ft. 3 in.
Firebox, length	80½ in.
Firebox, width	36 in.
Heating surface, firebox	119 sq. ft.
" " tubes	1,650 "
" " total	1,769 "
Six-wheel tender	3,700 gal.
Eight-wheel tender	4,000 gal.

Steam Engine Research.

At a meeting of the English Institution of Mechanical Engineers on March 17, Prof. D. S. Capper submitted a report of the Steam Engine Research Committee showing what had been done during the past six years in the investigation of the initial condensation in steam engine cylinders. After giving a description of the engine, etc., employed for the trial, and describing the main features of the experiments diagrammatically, the professor said that though it might be dangerous to draw conclusions of too general and sweeping a character from experiments on one type of engine under one set of conditions, thought it might fairly be claimed that the ground covered by the report had never previously been surveyed with an engine showing more definite and consistent results, nor under conditions that enabled so detailed an analysis of the results to be made. The points which had been elucidated he summarized as follows: First, leakage through the slide-valve, to the importance of which Messrs. Callendar and Nicolson had drawn attention, had been quantitatively determined under defined conditions, and shown to be nearly independent of speed of sliding surface and proportional to difference of pressure between the two sides of the valve. Further, the assumption that the leakage was inversely as the overlap of the valve was shown to be at least in the main well founded; and it appeared that with well-fitted valves the leakage might amount to over 20 per cent. of the steam entering the cylinder, and was rarely less than 4 per cent. Secondly, it had been shown that for an unjacketed engine with a given ratio of expansion, initial condensation, expressed as a percentage of the steam in the cylinder, diminished with increase of initial temperature, while the total condensation increased with such temperature increase. This, though suggested by Messrs. Callendar and Nicolson's researches, had never previously been demonstrated with clearness, since, if leakage were not allowed for, the results were obscured or even reversed. Thirdly, it appeared that the re-evaporation for a given ratio of expansion was as great and sometimes greater without jackets as with them, this result showing that the regenerative action of the cylinder walls with a given ratio of expansion was largely independent of their mean temperature. Fourthly, the results obtained indicated the temperature at which for any speed of revolution with a given expansion jacketing would become unnecessary or wasteful. If the heat-units per indicated horse power per minute required by the unjacketed engine for each speed of the series were plotted either on an initial pressure or a mean effective pressure base, the points for each speed would be found to lie on four curves, which became closer and closer to each other as the speed increased and converged to a point as pressure or temperature increased. When the heat-consumption for the jacketed series was likewise piloted, the points for the different speeds at each pressure lay irregularly round a point, their exact position being determined by the accidentally slight variations of the conditions of each trial. A fair curve through the means of these points would lie below the corresponding curves for the unjacketed trials; but, if the heat absorbed in the jackets were included, the resultant curve cut the unjacketed curves at points which for each speed indicated the pressure and temperature at which the jackets ceased to be economical.

The Fusan-Seoul Railroad.

The first through train from Fusan, at the southeastern extremity of Korea, and the nearest Korean port to Japan, northwest to Seoul, 270 miles, left Fusan on December 27 last. This road has been built by a company subsidized by the Japanese government.

When the work of construction was begun it was not expected that the line would be open for traffic until 1906, but the war made it imperative that it should be finished as early as possible. The engineers have pushed on the construction with great rapidity, and have accomplished their task a year earlier than they anticipated. In course of time this railroad will be connected with the Niuchwang-Mukden line, either by way of Dalny, or directly north from Wiju, and thus when the war is over it will be possible to travel direct from Fusan to St. Petersburg. After leaving Fusan the railroad skirts the coast for a few miles, and then strikes into the mountains. After traversing several valleys, it emerges into broad open plains, encircled by dark ranges of hills. Beyond these are the mountains, ridges of black rock, rising to a height of 5,000 ft., the higher peaks tinged with a slight fall of snow. Between Fusan and Teiku there are several large lakes connected by a broad river. The railroad runs close to the lake shore for some distance, and the embankments are here built of solid granite. For the greater part of the distance the track has been raised above the ground level, and lines of grass, about a foot apart, have been laid along the sides of the embankments to prevent the soil from slipping. The iron bridges have been extremely well-built on stone work foundations, while the construction across the mountains is a feat of engineering like that shown on the railroads of Switzerland. Two ridges have to be crossed, and in each case the line makes a wide curve, gradually ascending the steep slopes, and half way up enters a tunnel which pierces the mountain at a height of 2,000 ft. The line is well laid and there is

very little jolting. All the rolling stock has been imported from the United States; the locomotives are built by the Baldwin Works, the cars are made in Delaware, and the 90-lb. rails come from the Carnegie Steel Works. A great many of the stations are still in course of erection. The framework is of wood, with walls of bamboo, plastered over with mud, and the roofs tiled, which makes very neat looking buildings. All along the line there are Japanese soldiers, armed with rifles, supervising the building of the road and the bands of coolies at work. At Yong-tong-po, the new railroad joins the line running from Seoul to Chemulpo, the most important treaty port on the northwest coast of Korea.—*London Times.*

German Railroad Statistics.

The United States Consul-General at Frankfort, Germany, sends the following statistics of the German standard gage railroads in 1893 and 1903, taken from the returns of the German Federal railroad office, recently published.

STATISTICS OF GERMAN RAILROADS IN 1893 AND IN 1903.

Description.	1893.	1903.	Increase.
Mileage of standard gage road, miles	27,223	33,160	5,937
Rolling stock:*			
Locomotives, number	.....	20,845	.....
Motor cars, number	.....	49	.....
Passenger coaches, number	.....	42,096	.....
Baggage and freight cars, number	.....	427,788	.....
Receipts and expenses:			
Receipts:			
From passenger traffic	$91,600,000	$146,000,000	$54,400,000
From freight traffic	227,160,000	333,350,000	106,190,000
All other receipts (rents not included)	15,740,000	34,521,000	18,781,000
Total receipts	$334,500,000	$513,871,000	$179,371,000
Operating expenses	200,300,000	316,230,000	115,930,000
Officials and employees, number	417,188	559,451	142,263
Salaries and wages paid officers and employees	$122,040,000	$188,530,000	$66,490,000
Capital invested yielded, per cent	5.12	6.08	0.88

*Statistics showing the number of locomotives and cars for 1893 are not given, but the increases in 1903 over 1902 are designated in percentages as follows: Locomotives, 32.64; passenger coaches, 41.86; baggage and freight cars, 36.

The Baltimore & Ohio's New Passenger Station at Youngstown.

The Baltimore & Ohio Railroad is building a new passenger station at Youngstown, Ohio. It will be a thoroughly modern station, and will give ample facilities for all requirements. It will be located just off of Mahoning avenue, and will be 143 ft. in length by 50 ft. in width. The building will consist of two stories with porte cochere on the driveway side and one story on the track side. The general waiting room will be 40 ft. in length, or equal to the height of the two stories, and will be capable of seating 150 people. Contiguous to this room will be the ticket office, women's waiting-room, men's waiting-room, express and baggage-rooms, news-stand and telephone booths, and from this general waiting-room there will be a subway leading under and to each track. The local offices of the railroad company will be on the second floor of the building. It is to be finished throughout in quartered oak with marble mosaic floors. The exterior walls will be constructed of brown sandstone and gray pressed brick, and the roof will be covered with red tile.

The B. & O. is also building new passenger stations at Charleston, Wayland, Newton Falls and Kent, Ohio. A new freight station is also being built at Kent.

The Atmosphere in a Berth.

A western space writer has been inspired to produce the following observations on life in a sleeping car; though not from the observation end:

"Steady and stubborn pressure of public opinion will bring about reforms without legislation. An Indiana railroad has abolished the upper berth. For years the people have been against the upper berth; frequently up against it, either through haste or miscalculation while floundering around in the lower one. The objection to the upper berth does not lie so much in the necessity of occasionally occupying it, as in lying under it. It is a trying task to lay yourself calmly and carefully away in a cupboard, and further vexation to remain there; and with all their inventions the sleeping car makers have as yet provided no suitable place to put any part or parcel of your raiment. They leave you to the primitive resource of bestowing your clothing in crevices and crannies, as if you dwelt in a cave, or suspending it in a fishnet like a hammock, whose opening it is as impossible to find as that of the pocket in a woman's dress, and whose meshes are so large that your collar and necktie fall through in unending repetition.

"With no upper berth you might hang up your garments in orderly array, where, if necessary, you could lay hands on them when the train had rolled over three times down an embankment, instead of appearing in due time among your fellow-travelers in a brown blanket and bare feet. Then there is the additional excellence of air. Buttoning yourself into your lower berth, as it is now, your allowance of air for the night is buttoned in with you, and you get no more until daylight. So many cubic feet of air goes with each berth, and the company furnishes no more except in sultry summer weather, when they will supply you with a solution of coal smoke and common country air strained through a sieve. But with the upper berth removed a prime quality of breathing material passes through the car overhead, with neither the harassment of a bed full of cinders nor a stiff neck from an all-night draft. Civilization moves forward, and as it moves it shuts up the upper berth."

The Congressional Junket.

A statement has been issued by the Bureau of Insular Affairs of the War Department with regard to the trip to the Philippines which is to be made next summer by the Secretary of War and a party representing the Senate and the House of Representatives. The party will sail from San Francisco on the Pacific Mail steamer Manchuria July 1, and expects to be gone about three months, one month of which will be devoted to an inspection of the Philippine Islands. The persons who are going on the expedition are: Secretary Taft, ex-Secretary Root, Senators Daniel, of Virginia; Allison, of Iowa; Dubois, of Idaho; Foster, of Louisiana; Long, of Kansas; Newlands, of Nevada; Patterson, of Colorado; Scott, of West Virginia; Stone, of Missouri, and Warren, of Wyoming; Speaker Cannon, Representatives Bourke Cockran, of New York; Cooper, of Wisconsin; Crumpacker, of Indiana; Curtis, of Kansas; De Armond, of Missouri; Foss, of Illinois; Gillet, of Massachusetts; Grosvenor, of Ohio; Hepburn, of Iowa; Hill, of Connecticut; Howard, of Georgia; Jones, of Virginia; Longworth, of Ohio; McKinley, of Illinois; Payne, of New York; Scott, of Kansas; Sherley, of Kentucky; Smith, of Illinois, and Watson, of Indiana; Col. Clarence R. Edwards, U. S. A., Chief of Bureau of Insular Affairs, and Mr. Fred W. Carpenter, Private Secretary to the Secretary of War. Miss Roosevelt and a number of other guests will accompany the party in an unofficial capacity.

Trolley Losses in the Winter.

The *Street Railway Journal* prints the following comment on the results of winter weather in the operation of trolley lines: Unfortunately, the effect of the snowfall is not confined to the direct expense of removing it, but is reflected in other ways. In fact, the actual cost is but a small fraction of the total expense. The other principal results are: (1) Increase in repair cost; (2) decrease in gross receipts owing to interruption of schedules; (3) increase in power required. It is impossible to determine the exact extent to which these three items are influenced by severe winter weather, but the records on several railroads show that the repair account during the first quarter of 1904 was 50 per cent. larger than during the corresponding quarter of the previous year, and that the effect of the cold weather, so far as repairs were concerned, extended over even into the second quarter. The losses in receipts owing to the interruption of schedules and the increased power required are also very large, but owing to other conditions which affect them, the total cannot be accurately measured.

If the winters should continue to be as severe as they have been during the past two years, there would have to be a modification of all of our ideas of the cost of operation of electric roads. It is too much to expect, however, that for a long time to come there should be such a combination in any one or two years of such conditions. If investors and the public generally should recognize these conditions as exceptional and not general, there need be no unnecessary alarm at some of the reports which may appear during the next three months.

Observation Cars on the D. & R. G.

The Denver & Rio Grande is now building a number of open-top observation cars to be attached, during the summer months to daylight trains running through the Royal Gorge, Grand Canon of the Arkansas, Canon of the Grand river, and the Black Canon of the Gunnison. These cars are of modern construction and have a seating capacity of 72 persons; low sides, but no tops, being entirely open, and giving a free and unobstructed view of the scenery of the Rocky Mountains. These cars are expected to be in service not later than June 1.

New York Canal Bonds.

The award for the sale of $2,000,000 New York State barge canal improvement bonds has been made to Fisk & Robinson, of New York. This firm bid 102.313 for the entire issue, at which price the interest will be 2.85 per cent. This is the first bond issue under the Barge Canal Improvement Act.

Results Under Electric Traction in England.

The results of experiments in electric traction in England appear so far to have been satisfactory. The Taff Vale Railroad has found that the use of motor cars on its Nelson branch, five miles long, has increased the number of passengers and passenger revenue for that section by more than 50 per cent. The North Eastern, which adopted electric traction for its Tynemouth lines because of the severity of tramway competition, although such competition continues, has carried, on its electrified sections, 675,-

000 more passengers than in the corresponding half of the preceding year, and shows an increase of $82,620, or 27 per cent., in gross earnings for the same period.

The Lancashire & Yorkshire has found the increase in traffic on the Liverpool-Southport section to be far in excess of the most sanguine expectations. New service has been especially popular because of the facilities it offers for getting to intermediate stations.

Baltimore & Ohio Water Softening Plants.

Extensive improvements are to be made in the Baltimore & Ohio's water supply in Pennsylvania. A softening plant will be built at Emblem with a capacity of 30,000 gallons an hour, and one at Glenwood with a capacity of 100,000 gallons. River water has to be used on this section of the road, and impurities are often troublesome. At Layton, the present capacity of the reservoir will be increased, and at Griffin a dam is to be built. At Delmar, water will be taken from the Allegheny river and run into settling tanks.

The President Pays.

For the benefit of those who complain that the President does not pay his fare, the Colorado Midland states that the President's train on that road will be paid for at regular rates and that all bills for transportation will be settled through the auditing department of the Pennsylvania Railroad. The only special courtesy to be enjoyed by the President will be permission to ride on the engine through Red Rock Canyon.

Interstate Commerce Commission.

The Interstate Commerce Commission in an opinion by Commissioner Knapp, has rendered its decision in the case of Koch against the Pennsylvania Railroad and the P., C., C. & St. L. It is held that shippers are not entitled as a matter of right to mill grain in transit and forward the milled product under the through rate in force on the grain from the point of origin to the place of ultimate destination; but allowance of the privilege by a carrier to shippers in one section must be without wrongful prejudice to the rights of shippers in another section served by its line. Considering the two defendants as a single line, the granting of transit milling west of Pittsburg and denying it to millers at Harrisburg is not necessarily unlawful, because conditions on that line in Ohio and Indiana may be very different from conditions in eastern Pennsylvania; and it does not follow that the allowance of transit privileges in the former territory requires as a matter of law the like allowance in the latter territory; but such differences have not been shown, nor their bearing explained, by the testimony in this proceeding, and upon the meagre and incomplete facts now appearing, the Commission is not warranted in making a decision which in principle, if complainant's contention is well founded, would involve a general extension of transit privileges into a large territory where heretofore such privileges have not been allowed. The case is continued for further hearing.

Manufacturing and Business.

After May 1 the western office of the Nathan Manufacturing Co. will be at 485 Old Colony Building, Chicago.

After May 1 the executive offices of the Magnus Metal Company will be in the Trinity Building, 111 Broadway, New York City.

The Farlow Draft Gear Company, Baltimore, Md., announces the receipt of miscellaneous orders for 300 sets of its Farlow draft gear.

A quarterly dividend (No. 153) of $2 a share from net earnings has been declared by the Pullman Company, payable May 15 to stockholders of record at close of business April 29, 1905.

The Iron and Steel Industries Board of Trade of Passaic has been incorporated in New Jersey, with a capital of $350,000, to sell iron and steel. Incorporators are Arthur S. Corbin, J. S. Davison and H. H. Williams, all of Passaic.

Mr. L. D. Bolton, heretofore Chicago representative of the Federal Manufacturing Company, is now with the Diamond Chain & Manufacturing Company, of Indianapolis, and will represent that company in the middle and western states.

The Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, announces that it has received a large order for its Falls hollow staybolt iron from the Western Australian Government Railways; also one from the Cuba Company, for shipment to Cuba.

It is reported that the Metropolitan Railroad of London will soon begin to haul its main line trains which run to Aylesbury and Verney Junction, by electric locomotives as far as Harrow. At this point the electric locomotives will be taken off and replaced by steam locomotives.

E. H. Mumford and C. S. Lovell, formerly of the Tabor Mfg. Co., Philadelphia, have formed the E. H. Mumford Co. The new company will make a new line of moulding machines, and will have headquarters with Edwin Harrington, Son & Co., Philadelphia, Pa.

The S. A. Woods Machine Co., Boston, Mass., has moved the offices of its western department from the Merchants' Loan and Trust Building in Chicago to the Railway Exchange Building. Mr. R. B. Dunsmore, the company's western manager, is in charge of the office.

W. S. McGowan, Jr., has been made Eastern Sales Manager of the American Brake-Shoe & Foundry Co., with office at 170 Broadway, New York City. The appointment takes effect May 1. Mr. McGowan is well-known to many of our readers, having been identified with the railroad supply business for some years past.

The Miller-Collins Company has just been formed by S. Fischer Miller and D. C. Newman Collins, for the purpose of doing a contracting and engineering business through the east and middle states. It will make a specialty of industrial plants, engineering buildings, and steel-concrete, structural steel and masonry construction. The main office of the company is St. James Building, Broadway and 26th street, and the downtown office is at 29 Broadway, New York City.

Harold P. Brown, Electrical Engineer, 120 Liberty street, New York, will exhibit at the International Railway Congress at Washington next month various types of electric rail bonds, especially those suitable for steam roads which may equip for electrical operation. In connection with this exhibit will be operated a complete electrical testing plant with a capacity of 3,000 amperes for testing various types of rail bonds, fuses or electrical apparatus. This testing plant will be at the disposal of any visiting engineers.

J. W. Duntley, President of the Chicago Pneumatic Tool Company, left recently for Europe for the purpose of demonstrating personally several styles and sizes of the company's electric drills to the trade of the Consolidated Pneumatic Tool Company. It is expected that a number of large orders will result from the trip. The Chicago Pneumatic Tool Company reports present business to be the best in its history. March was the best month since May, 1903, and the business of April up to the 18th had exceeded the corresponding period in March by 49 per cent., and the corresponding period in 1904 by 222 per cent. A gratifying increase in foreign business is also reported.

Mr. F. H. Jones, formerly manager of the air compressor branch of the sales department of the International Steam Pump Co., has been appointed General Sales Manager of that company and will have charge of the organization of a general sales department for all branches of the company's business. The International Steam Pump Company controls the Henry R. Worthington Pump Co., Harrison, N. J.; George F. Blake Mfg. Co., East Cambridge, Mass.; Knowles Steam Pump Works, East Cambridge; Laidlaw-Dunn-Gordon Co., Cincinnati, Ohio; Snow Steam Pump Works, Buffalo, N. Y.; Holly Manufacturing Co., Buffalo, N. Y.; Deane Steam Pump Works, Holyoke, Mass., and the Clayton Air Compressor Works, Brooklyn, N. Y. The output of these works includes water-works pumping engines, steam pumps, centrifugal pumps, vacuum pumps, air compressors, jet, surface and elevated condensers, cooling towers, feed-water heaters, marine pumping apparatus, water meters and many other types of hydraulic and pneumatic machinery.

The Westinghouse Companies are to move on May 1 from the Equitable Life Building, 120 Broadway, to the Trinity Building, 111 Broadway, New York City. The executive offices of the Westinghouse Electric & Manufacturing Co. will be on the nineteenth floor of the Trinity Building and the eastern sales offices of the Westinghouse Air-Brake Co. and of the Westinghouse Traction Brake Co. are to occupy a large part of the twentieth floor. The New York sales offices of the Westinghouse Electric Co. will remain in the Hanover Bank Building, corner Pine and Nassau streets. With them will be connected the New York office of the Westinghouse Companies' Publishing Department, formerly at 10 Bridge street. The export offices of the Westinghouse Electric Co. will continue in the Hanover Bank Building under the management of Mr. Maurice Coster, who has been appointed to succeed Mr. F. B. H. Paine. The office of Mr. Charles S. Powell, the new General Agent of the company, will also be connected with the sales and export offices. Mr. Coster and Mr. Powell have recently returned, one from Paris, the other from London, after long terms of successful service abroad. Mr. Powell is a brother of Mr. Thomas Carr Powell, recently appointed Fifth Vice-President of the Southern Railway.

Iron and Steel.

A contract has recently been given to the Snare & Triest Co., New York, for the construction of a large steel pier at Cienfuegos, Cuba, for the Cardenas & Jucaro Railroad. The amount of steel work required will be about 2,000 tons.

The American Bridge Co. has orders for about 3,500 tons of viaduct works for the Queen & Crescent Railroad, 1,350 tons for the Pennsylvania Lines West of Pittsburg, and 300 tons for the Pere Marquette; also for 4,000 tons of fabricated steel for the Atchison, Topeka & Santa Fe.

The McClintic-Marshall Construction Co. has secured contracts for the steel for the new building for the Halcomb Steel Co. in Syracuse, N. Y., aggregating about 1,000 tons, and for the Barney & Smith Car Co. in Dayton, Ohio, 17,500 tons. This company has also started on the steel work for the Du-

quesne Way elevated tracks, in which 5,000 tons of steel will be used.

The statement of the United States Steel Corporation for the quarter ending March 31, indicates the present thriving condition of the steel industry. Net earnings for the quarter, $23,025,896, show an increase of nearly $10,000,000 over the figures for the corresponding quarter of 1904; and the unfilled orders on hand on March 31, 5,597,560 tons, were the largest on record. The net earnings by months compare as follows with those of the same period in 1904 and 1903:

	1905.	1904.	1903.
January	$6,810,847	$2,868,213	$7,425,775
February	6,629,463	4,540,673	7,730,361
March	9,585,586	6,036,346	9,912,571
Total	$23,025,896	$13,445,232	$25,068,707

The directors declared the regular quarterly dividend of 1¾ per cent. on the preferred stock payable May 31.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

Franklin Institute.

At a stated meeting of the Sections April 27, the program included a paper on "Internal Combustion Engines" by Professor H. W. Spangler.

Canadian Society of Civil Engineers.

At a meeting of the general section April 20 papers were read on "The Construction of a Timber Dry-Dock at Baltimore," by G. B. Ashcroft, and "The Bout de l'Isle Bridge," by J. L. Morris.

PERSONAL.

—Mr. B. E. Palmer, who has recently been appointed Assistant General Superintendent of the Northern Pacific, with headquarters at Tacoma, Wash., began railroading in 1885, in the engineering department of the Union Pacific, where he was engaged in construction and location work in various states. From 1891 to 1895 he did general engineering work in Washington and British Columbia, and entered the service of the Northern Pacific in 1896 as Resident Engineer of the Rocky Mountain Division. Later he was made Roadmaster and Supervisor of Bridges and Buildings. From this position he reentered the engineering department as Division Engineer, with territory from Mandan, N. Dak., to Ellensburg, Wash. In April, 1902, he was appointed Superintendent of the Rocky Mountain Division, from which place he has now been promoted to be Assistant General Superintendent.

—Mr. John M. Rapelje, who on April 10 was appointed Superintendent of the Yellowstone Division of the Northern Pacific, with headquarters at Glendive, Mont., was born in 1857, at Niagara Falls, Canada. In 1880 he entered the service of the Grand Trunk at Port Huron, Mich., as brakeman. He went to Winnipeg, Manitoba, in 1882, where for five years he was employed as a conductor on the Canadian Pacific. In January, 1883, he went to the Northern Pacific at Glendive, where he was employed as conductor for six years, and in 1889 was appointed Trainmaster of the division. This position he held until 1901, when, for personal reasons, he resigned and resumed his passenger run between Glendive and Billings. In 1903 he was again appointed Trainmaster, which position he held until his recent appointment as Superintendent.

—Mr. Henry U. Mudge, who has just been made Second Vice-President in charge of maintenance and operation of the Chicago, Rock Island & Pacific, was born at Minden, Mich., June 9, 1856. With the exception of six months as Trainmaster on the Texas & Pacific, Mr. Mudge's entire career has been on the Santa Fe. He began at the age of 16 as water carrier for a construction gang. He studied telegraphy, and in 1874 became an extra operator. From 1876 to 1888 he served as baggage man, trainman, conductor, train dispatcher, foreman in charge of construction train, roadmaster and trainmaster. On January 1, 1890, he was made Superintendent of the Rio Grande division, and in 1893, of the Western division. On May 1, 1893, he was appointed General Superintendent of the Western Grand division. He was transferred to the Eastern Grand division in 1894, and February 1, 1896, was made General Superintendent of the entire system. On January 1, 1900, he was made General Manager, which position he leaves to go to the Rock Island.

—Mr. H. S. Balliet, who has been appointed Engineer of Maintenance of Way of the Grand Central Station, New York City, has been in the signal department of the Lehigh Valley for the last 11 years and has been Assistant Signal Engineer since 1901. To readers of the *Railroad Gazette* he needs no introduction, being well known as Secretary of the Railway Signal Association and author of a series of articles on the care of automatic signals recently published in these columns. Mr. Balliet was born in Neffsville, Lehigh County, Pa., Feb. 28, 1868, and his first work was as a telegraph operator. He was in the service of the Western Union and of the United Press. For a short time he worked for the Philadelphia & Reading as agent and operator, and his first service with the Lehigh Valley was as operator and electrician.

—Mr. W. B. Scott, who has recently been made Assistant Director of Maintenance and Operation of the Southern Pacific lines, was born in Hamilton, Ont., in 1862, and was educated at Martin's Academy in Guelph, Ont. He began railroad work as a messenger on the Grand Trunk in 1873, and remained for 10 years on that road in various positions. From 1883 to 1887 he was Train Despatcher on the Canadian Pacific at Winnipeg, and for the next two years was Chief Train Despatcher and Trainmaster on the Great Northern. In 1889 he was made Superintendent of Telegraph of the Chicago Great Western, and in 1890 was appointed Trainmaster at Chicago of the Atchison, Topeka & Santa Fe. This position he held for seven years, when he was made Superintendent of the Gulf, Colorado & Santa Fe at Temple, Tex. Mr. Scott also served for a time with the Galveston, Harrisburg & San Antonio. On June 1, 1904, he was made General Superintendent of the Houston & Texas Central and the Houston, East & West Texas, which position he held until promoted to his present post. A portrait of Mr. Scott was published in our issue of June 10 last.

—Mr. F. H. Clark, who has just been appointed General Superintendent of Motive Power of the Chicago, Burlington & Quincy, was for several years a consulting engineer in Chicago, in the office of D. L. Barnes, and was also one of the editorial staff of the *Railroad Gazette*. Mr. Clark was graduated from the University of Illinois in the class of 1890 as a Mechanical Engineer, and four years later was appointed Chief Draughtsman of the C., B. & Q. On March 1, 1902, he was appointed Superintendent of Motive Power of the Lines East of the Missouri River, succeeding Mr. J. F. Deems, which position he has held up to his present appointment as General Superintendent of Motive Power of all the Burlington lines, both east and west of the Missouri.

—Mr. O. M. Dunn, who has recently been appointed Superintendent of the New Orleans terminals of the Illinois Central, began his railroad career at the age of 16 as a telegraph operator on the Lake Shore & Michigan Southern. He remained with that company until 1872, when he went south on account of his health and entered the service of the Louisville & Nashville, with which company he remained until 1892, being Division Superintendent for the last 10 years of this time. In 1892 he became Superintendent of Southern Lines of the Illinois Central. This position was soon after abolished and he was appointed to the Superintendency

of the Louisiana division. Here Mr. Dunn has been ever since; and for two years he was Assistant General Superintendent of Southern Lines with headquarters in New Orleans. When the headquarters of the Assistant General Superintendent were moved to Memphis, he chose to remain in New Orleans as Superintendent. On account of the greatly increased business of the Illinois Central at New Orleans, it has lately become

necessary to separate the New Orleans terminals from the Louisiana division, and Mr. Dunn has been made Superintendent of Terminals.

—Mr. Frederic. A. Delano, who recently retired from the Burlington, is not long out of railroad service; and his appointment to the Vice-Presidency of the Wabash, announced this week, seems to indicate a decided change in the spirit of the management of that company. Mr. Delano takes with him to the Wabash a prominent Burlington man, Mr. Henry Miller. Mr. Delano scarcely needs an introduction to the readers of the *Railroad Gazette*, as he has been prominent not only as a railroad officer, but as a student, a speaker and a writer. He was born at Hongkong, China., September 10, 1863, graduated from Harvard in 1885 and immediately entered railroad service on the

Chicago, Burlington & Quincy as Machinist's Apprentice. After filling several different positions in the engineering and operating departments, he was appointed Superintendent of Freight Terminals, at Chicago. In 1899 he was made Superintendent of Motive Power, and in 1901 Vice-President and General Manager of the Lines East of the Missouri river, from which position he resigned in the latter part of last year.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—See Chicago, Rock Island & Pacific.

Atchison, Topeka & Santa Fe (Coast Lines).—F. W. McDonald, who has been Traveling Freight Agent at Los Angeles, Cal., has been appointed Industrial Commissioner, with headquarters at San Francisco.

R. W. Hobart, who was heretofore Contracting Freight Agent at San Francisco, has been appointed General Agent at Fresno, Cal., succeeding F. A. Jones. See Santa Fe, Prescott & Phœnix.

Buffalo & Susquehanna.—M. N. McMahon, who has been Division Freight and Passenger Agent at Galeton, has been appointed Assistant General Freight and Passenger Agent, with office at Buffalo. He will have charge of the freight and passenger departments until a successor to H. H. Gardiner, General Freight and Passenger Agent, recently resigned, is appointed.

Chicago & Eastern Illinois.—W. J. Hoskins, who has been General Foreman of the Hannibal shops of the Chicago, Burlington & Quincy, has been appointed Master Mechanic, with headquarters at Danville, Ill., succeeding S. T. Park, recently appointed Acting Superintendent of Motive Power.

Chicago, Burlington & Quincy.—F. H. Clark, Superintendent of Motive Power of the Lines East of the Missouri River, has been appointed General Superintendent of Motive Power of the entire Burlington system, with headquarters at Chicago. F. A. Torrey, Assistant Superintendent of Motive Power, has been appointed to the place vacated by Mr. Clark.

G. W. Rhodes, General Superintendent of the Wyoming district, has resigned after 25 years of service with the road. Mr. Rhodes will be succeeded by J. R. Phelan, Superintendent of the Alliance division. J. C. Birdell, Assistant Superintendent, has been appointed Superintendent, with headquarters at Alliance, Neb., succeeding Mr. Phelan.

W. S. Kirby has been appointed Superintendent of the Chicago division, succeeding H. L. Hetzler, who recently resigned to become President of the Metropolitan Elevated.

See Wabash.

Chicago, Rock Island & Pacific.—John F. Stevens, Second Vice-President, has resigned, and H. U. Mudge, General Manager of the Atchison, Topeka & Santa Fe, has been elected as his successor in charge of maintenance and operation of the system.

W. C. Taylor, Division Engineer of the Kansas Division, has been transferred to the El Paso Division, with headquarters at Dalhart, Texas. W. A. Van Frank, Division Engineer, Missouri Division, succeeds Mr. Taylor, with headquarters at Topeka, Kan. C. M. Case, Division Engineer of the El Paso Division, has been transferred to the Missouri Division, with headquarters at Trenton, Mo., succeeding Mr. Van Frank.

E. D. Andrews, who has been Road Foreman of Equipment of the Choctaw Division, has been appointed Master Mechanic of the El Paso Division, with headquarters at Dalhart, Texas.

Chicago Warehouse & Terminal.—Walter G. Collins, formerly General Manager of the Chicago, Milwaukee & St. Paul, has been elected President of the Chicago Warehouse & Terminal Co., which controls the Illinois Tunnel Company's freight subways in Chicago.

Cincinnati, Hamilton & Dayton.—A. J. Anderson has been appointed Assistant Auditor of Passenger Traffic, with office at Cincinnati, Ohio.

Cleveland, Cincinnati, Chicago & St. Louis.—G. H. McDonough has been appointed Signal Engineer.

Colorado & Southern.—C. H. Bevington, Assistant Superintendent at Trinidad, Colo., has been appointed Superintendent of the Colorado & Southeastern, with headquarters at Hastings, Colo. Mr. Bevington is succeeded by A. J. Gausewitz, formerly Superintendent on the Illinois Central.

Detroit Southern.—C. P. Lamprey, who has been General Manager of the Erie Despatch, has been appointed General Traffic Manager.

Erie.—The office of G. A. Heller, Superintendent of the Delaware division, has been moved from Port Jervis, N. Y., to Susquehanna, Pa., and 50 miles of the Delaware division have been transferred to the authority of M. C. Roach, Division Superintendent at Jersey City. The headquarters of W. J. Sharp, Superintendent of the Susquehanna and Tioga divisions, has been moved from Elmira, N. Y., to Hornellsville, and the headquarters of J. C. Tucker, Superintendent of the Allegheny division, from Hornellsville to Salamanca.

Houston, East & West Texas.—See Houston & Texas Central.

Huntington & Broad Top Mountain.—J. A. Greenleaf, who has been Chief Clerk, has been appointed Superintendent.

Galveston, Harrisburg & San Antonio.—S. C. Marks, who has been Trainmaster of the El Paso Division, has been appointed Superintendent, with headquarters at El Paso, succeeding A. S. Johnson. George S. Ward, who has been conductor on the Houston Division, has been appointed to succeed Mr. Marks. See Houston & Texas Central.

Galveston, Houston & Northern.—See Houston & Texas Central.

Great Northern.—The headquarters of the Northern division have been moved from Grand Forks, N. Dak., to Crookston, Minn.

Gulf, Colorado & Santa Fe.—R. S. Gordon has been appointed General Baggage Agent, with headquarters at Galveston, Tex., succeeding Daniel Driscoll, deceased.

Houston & Texas Central.—G. F. Hawks, Superintendent of the Galveston, Houston & Northern and the Texas & New Orleans, has been appointed General Superintendent of this company, the Houston, East & West Texas, and the Houston & Shreveport, succeeding W. B. Scott, recently promoted to be Assistant Director of Maintenance and Operation of the Southern Pacific and allied lines. Mr. Hawks is succeeded by A. S. Johnson, who has been Superintendent of the Galveston, Harrisburg & San Antonio at El Paso, Tex.

Lake Shore & Michigan Southern.—Frank H. Wilson, who has been Trainmaster of the Michigan Division, has been appointed Assistant Superintendent of the Chicago Division, succeeding S. W. Brown, promoted to be Superintendent.

Mexican Southern.—Harold Miles, who has been Secretary to the General Manager, has been promoted to be Assistant to the General Manager.

Michigan Central.—W. S. Kinnear, who has been Chief Engineer, has been made Assistant General Manager.

Missouri Pacific.—C. H. Middleton has been appointed assistant to C. S. Clarke, Vice-President.

W. K. Walker has been appointed Division Engineer, with headquarters at Pueblo, Colo.

National of Mexico.—Frederick E. Young has been appointed General Passenger Agent, with headquarters in the City of Mexico, succeeding Jackson Smith.

New Orleans & Northwestern.—A. E. Baynes has been appointed Assistant Engineer.

Oregon Railroad & Navigation.—George W. Boschke, who was in charge of the Southern Pacific's Galveston improvements and of the building of the sea wall at Galveston for the county, has been appointed Chief Engineer of this road, and of the Southern Pacific lines in Oregon, with headquarters at Portland, succeeding W. H. Kennedy, resigned, owing to protracted illness.

Pennsylvania.—J. H. Fulmer has been appointed Master Mechanic of the Schuylkill division. H. H. Maxfield, who has been Assistant Engineer of Motive Power at Jersey City, has been appointed Master Mechanic, with headquarters at Trenton, N. J.

St. Joseph & Grand Island.—J. Berlingett, who has been Superintendent, has been appointed Acting General Manager, succeeding Raymond Du Puy, Vice-President and General Manager, resigned.

St. Louis, Kansas City & Colorado.—C. A. Bradley has been appointed Division Engineer, succeeding Ralph Budd, resigned.

Santa Fe, Prescott & Phoenix.—F. A. Jones, who has been General Agent of the Atchison, Topeka & Santa Fe at Fresno, Cal., has been appointed General Freight and Passenger Agent, with headquarters at Prescott, Ariz., succeeding H. P. Anewalt, promoted.

Southern.—C. E. Gay, Jr., has been appointed General Agent of the Passenger and Freight Departments at Havana, Cuba, succeeding J. L. Edwards, promoted.

Southern Illinois & Missouri Bridge.—F. H. Britton, President of this company, has announced the following appointments: W. E. Green, General Superintendent; M. L. Lynch, Chief Engineer; J. S. Berry, Superintendent Bridges and Buildings, all with headquarters at Tyler, Tex.; E. A. Peck, Superintendent, with headquarters at Pine Bluff, Ark.; O. E. Maer, Trainmaster, and C. J. Lake, Chief Train Despatcher, with headquarters at Illmo, Mo. J. S. Ford, in addition to his duties as Secretary and Treasurer, will attend to the accounting work of the company, with office at Chicago.

Southern Pacific.—Thomas McCaffey, who has been Trainmaster, has been appointed Assistant Superintendent of the Los Angeles Division, with headquarters at Los Angeles, Cal., succeeding W. A. McGovern, who nearly a year ago was made Superintendent of the Arizona Division. Mr. McCaffey is succeeded by E. A. Brown, who has been Chief Despatcher of the Los Angeles Division.

See Houston & Texas Central and Oregon Railroad & Navigation Co.

Texas & New Orleans.—See Houston & Texas Central.

Texas Southeastern.—E. H. Payne has been appointed General Manager, with headquarters at Diboll, Texas, succeeding J. R. Raef, resigned.

Union & Glen Springs.—P. I. Welles has been appointed Vice-President and General Manager of this company, which is building a line in South Carolina.

Union Pacific.—Charles Ware, who has been Assistant Superintendent of the Nebraska Division, with headquarters at Omaha, has been appointed Superintendent of the division, succeeding W. A. Deuel, who recently went to the Denver, Northwestern & Pacific. The report of the appointment of H. C. Ferris as Mr. Deuel's successor is erroneous.

Wabash.—Frederic A. Delano, who was last week elected President of the Wabash-Pittsburg Terminal, has been elected Vice-President in charge of all the Wabash properties, with office at Chicago. Henry Miller, General Superintendent of the Missouri District of the Burlington, has been appointed General Manager of the Wabash, with headquarters in St. Louis. Cyrus J. Lawrence, who has been a director of the Wabash for 16 years, has resigned.

Wabash-Pittsburg Terminal.—W. H. Purdy, Assistant Chief Engineer Maintenance of Way, has resigned.

See Wheeling & Lake Erie.

Wheeling & Lake Erie.—W. M. Bonar, who has been Acting Auditor, has been appointed Auditor of this road and of the Wabash-Pittsburg Terminal.

Youngstown & Southern.—President A. W. Jones, of this company, has resigned, and C. P. Phelps, who has been Vice-President, has been elected his successor.

LOCOMOTIVE BUILDING.

The Coal & Coke has ordered two locomotives from the Baldwin Works.

The Kansas City Belt Line has ordered two locomotives from the Baldwin Works.

The New South Wales Railroads have ordered 20 locomotives from the Baldwin Works.

The Long Island is having two electric locomotives built at the Juniata shops of the Pennsylvania.

The Pennsylvania will, it is reported, build 180 locomotives at its Juniata shops during the next 12 months.

The Panama Railroad has ordered 24 double-end mogul locomotives to weigh 170,000 lbs. from the American Locomotive Co. for July 1 delivery.

The Baltimore & Ohio has ordered 210 consolidation (2-8-0) freight locomotives and 35 Pacific type (4-6-2) passenger locomotives from the American Locomotive Co. and five switching locomotives from the Baldwin Locomotive Works for August to December delivery.

The Atchison, Topeka & Santa Fe has ordered 12 simple six-wheel switching locomotives from the Baldwin Works for August and September delivery instead of 40, as reported in our issue of April 14. These locomotives are to weigh about 144,000 lbs. on drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; wagon-top boiler, with a working steam pressure of 180 lbs.; heating surface, 1,928 sq. ft.; 281 Tyler iron tubes, 2 in. in diameter and 11 ft. 10¾ in. long; Luken's open-hearth steel firebox, 102⅛ in. x 41¼ in.; grate area, 29 sq. ft.; tank capacity, 3,900 gallons, and coal capacity, eight tons. The special equipment will include: Westinghouse-American air-brakes, Gollmar bell ringers, Chicago Railway Equipment Co.'s brake-beams, Tower couplers, A., T. & S. F. standard headlights, Ohio injectors, Hewitt Manufacturing Co.'s journal bearings, United States metallic piston and valve rod packings, Crane Co.'s safety valves, Leach sanding devices, Chicago sight-feed lubricators, Simplex Railway Appliance Co.'s springs, Crosby steam gages, Standard Steel Works' driving wheel tires and wheel centers, and Griffin cast-iron tender wheel tires.

CAR BUILDING.

The Chicago & Alton is reported to have ordered six gasolene motor cars.

The Isthmian Canal Commission has ordered 12 dump cars from the Pullman Co.

The New Orleans & Northeastern has ordered four coaches and two baggage cars from Barney & Smith.

The Mexican Electric Tramways of Mexico City are reported to have ordered 20 cars from the St. Louis Car Co.

The Cambria Coal Company is reported to have ordered 80 coal cars from the McKees Rocks Works of the Pressed Steel Car Co.

The Memphis Street Railway is reported to have ordered 20 thirteen-bench double-truck trailers and 50 ten-bench open cars for June to July delivery.

The Des Moines Interurban has ordered eight vestibule cars for interurban service from the American Car & Foundry Co. These cars are to be 50 ft. long and 8 ft. 7 in. wide, with smoking compartment, toilet rooms and passenger apartments. They are to be heated by hot water and equipped with air-brakes, both operated by electric power. Two of the cars are for July delivery and the other six for fall delivery. An observation car is also being built for the company at the shops of the Des Moines City Railway.

The Chesapeake & Ohio, as reported in our issue of April 14, has ordered 1,000 self-clearing hopper cars and 500 twin hopper cars of 100,000 lbs. capacity from the Pressed Steel Car Co. The self-clearing hopper cars will weigh 38,000 lbs. and measure 30 ft. 5 in. long and 9 ft. 6 in. wide, inside measurements. The twin hopper cars will weigh 40,000 lbs., and measure 40 ft. long, 9 ft. 7 in. wide and 4 ft. 2 in. high. The special equipment for both will include: Westinghouse air-brakes, Pressed steel brake-beams, Ajax brasses, R. E. Janney couplers, Miner tandem draft rigging and Chesapeake & Ohio standard arch-bar trucks.

The Great Northern, as reported in our issue of April 7, has ordered 11 observation parlor, four dining and three 16-section sleeping cars from the Pullman Co.; 15 first-class coaches and 10 smoking cars from Barney & Smith; and 10 combination baggage and express cars of 60,000 lbs. capacity from the American Car & Foundry Co., all for August delivery, except those ordered from the American Car & Foundry Co., which are for July delivery. The observation parlor cars will weigh about 125,000 lbs. and measure 72 ft. 8 in. long, over end sills; 9 ft. 8 in. wide, over side sills, and 6 ft. 10 in. high from top of sill to bottom of plate. The dining cars will weigh about 115,000 lbs., and measure 70 ft. long, over end sills; 9 ft. 8 in. wide, over side sills, and 6 ft. 8¾ in. high from top of sill to bottom of plate. The sleeping cars will weigh about 125,000 lbs., and measure 74 ft. long, over end sills; 9 ft. 8 in. wide, over side sills, and 6 ft. 10 in. high from top of sill to bottom of plate. The first-class coaches will be 72 ft. 6 in. long, over end sills; 9 ft. 8 in. wide, over side sills, and 6 ft. 8¾ in. high from top of sill to bottom of plate. The smoking cars will be 60 ft. long, over end sills; 9 ft. 8 in. wide, over side sills, and 6 ft. 8¾ in. high from top of sill to bottom of plate. The combination baggage and express cars will be 60 ft. 9 in. long, over end sills; 9 ft. 10 in. wide, over side sills, and 6 ft. 7 in. high from top of sill to bottom of plate. The special equipment for all will include: National-Hollow brake-beams, Streeter brake-shoes, Tower couplers, Forsyth curtain fixtures and Pantasote curtain material for all but combination baggage and express cars, Pullman door fastenings for cars ordered from the Pullman Co., and Dayton door fastenings for cars ordered from Barney & Smith; Symington dust guards, journal boxes and lids; Monitor roofs for combination baggage and express cars; Pullman standard seats for all cars ordered from the Pullman Co., and Barney & Smith and Simplex springs.

BRIDGE BUILDING.

BATESVILLE, ARK.—The Commissioners of Independence County have been petitioned to build a steel bridge over the White River at this place to cost $75,000.

BIRMINGHAM, ALA.—The board of revenue has authorized the County Engineer to prepare plans and at once ask bids for building nine steel bridges in Jefferson County.

BOSTON, MASS.—According to reports, the Secretary of War has authorized the construction of a bridge at Northern avenue over Fort Point Channel, and the removal of the one at Mount Washington avenue.

CLEVELAND, OHIO.—A high level bridge to be 435 ft. long and 50 ft. wide is to be built through Washington Park.

DAYTON, KY.—The Chesapeake & Ohio will build a bridge 300 ft. long at this place, also one at Brent, of the same length, to carry two tracks.

HARRISBURG, PA.—The Philadelphia & Reading, it is reported, has given contracts for building a number of steel bridges on its Philadelphia, Harrisburg & Pittsburg line, in connection with double tracking, as follows: At East Moor's Mill, to Lewis F. Shoemaker & Co., of Pottstown; bridge over the public road at Dillsburg and Mechanicsburg crossing, to the Phœnix Bridge Company; bridge over the stream and the Cumberland Valley tracks at Dillsburg Junction, to the Keystone Structural Company of Royers-

ford; bridges Nos. 22 and 23 at Granthem, to the Phœnix Bridge Company; also for a steel footbridge over the Pennsylvania tracks in Harrisburg to Enos L. Seeds, of Philadelphia.

LOS GATOS, CAL.—A contract is reported let to John Doyle to build a cement and stone bridge over Los Gatos Creek at his bid of $23,327. Other bids were D. E. Brown, $26,400; Granite River Company, $23,400; San Francisco Bridge Company, $23,840; Clark & Henery, $23,380; Burrill Construction Company, $24,997; Dundon Bridge Company, $24,750, and Cotton Bros. & Co., $23,588.

MERIDIAN, MISS.—A committee has been appointed to arrange with the railroads entering this place for building a combined highway and street railway bridge over the tracks, to cost $40,000.

MT. HOLLY, PA.—The Town Council has passed a resolution granting permission to the Philadelphia & Reading, and the Carlisle & Mt. Holly Electric Railway Co., to jointly build a subway under the former's tracks on Baltimore avenue.

NEWARK, N. J.—Plans, it is reported, have been approved for building the proposed bridge over the Passaic river at Delavan avenue by the joint committees of Essex and Hudson Counties. The plans, which were made by Essex County Engineer James Owen, call for a structure 455 ft. long, with a draw of 255 ft., to be 25 ft. above high water.

NILES, MICH.—The South Bend & Southern Michigan, it is reported, will build on its proposed interurban line from Niles through Berrien Springs to St. Joseph, about 18 bridges, one of which is to be 1,600 ft. long over the river at Berrien Springs.

PITTSBURG, PA.—Bids are wanted May 17 for building the stone arch over Beechwood Boulevard, to consist of two spans each 130 ft. long and 50 ft. wide, for which an appropriation of $151,000 has been made. A. W. Burk, Superintendent of Public Works.

THEBES, ILL.—The new bridge over the Mississippi river from this place to Gray's Point, Mo., has been opened to traffic, but the formal opening will be made on May 20. The work has been under way for the past three years and the completed structure cost $1,500,000. It is a double track structure with a location where the river banks are high, doing away with the necessity of long approaches. The total length of the bridge proper is 3,807 ft.

WILLIAMSPORT, PA.—Viewers recommend the building of a bridge over Lycoming Creek to cost $40,000, to replace the structure destroyed by floods last year.

WINNIPEG, MANITOBA.—Estimates have been submitted by H. N. Ruttan for bridges to be built over the Red River as follows: At St. Johns avenue, a bridge with a 20-ft. roadway, and two sidewalks each six feet wide, to cost $75,000, and for a bridge in the vicinity of James and Market streets, 32 ft. wide, to cost $138,000, or for one 38 ft. wide to cost $154,000.

Other Structures.

BOWLING GREEN, KY.—The Louisville & Nashville, it is reported, will put up a new passenger station to cost about $100,000.

BUCYRUS, OHIO.—The shops of the Toledo & Ohio Central at this place are to be enlarged and new equipment added.

CARBONDALE, PA.—The Delaware & Hudson, it is reported, has plans ready for putting up a large roundhouse to contain 67 stalls.

CINCINNATI, OHIO.—A contract, it is reported, is about to be let by the Queen & Crescent to the Collier Bridge Company, of Indianapolis, for a new concrete freight house and office.

DECATUR, ALA.—The Alabama State Railroad Commission has directed that work on a union passenger station be commenced before the first of next month.

DES MOINES, IOWA.—The Minneapolis & St. Louis has petitioned the City Council for a site to build freight and passenger stations and for its terminal.

HOPKINSVILLE, KY.—Contract is reported let to a local firm by the Louisville & Nashville for putting up a brick freight house to cost $20,000.

HOUSTON, TEXAS.—The International & Great Northern will soon put up a large office building, freight house and terminal on the site fronting on Franklin avenue and Jacinto street.

LITTLE ROCK, ARK.—The St. Louis, Iron Mountain & Southern, local reports state, has decided to repair its construction shops in this city and build new ones on a larger scale to replace those destroyed by fire some time ago.

MADISON, WIS.—The Chicago, Milwaukee & St. Paul, it is reported, will put up a stone passenger station to cost $25,000.

MILWAUKEE, WIS.—Improvements, it is reported, will be made to the Chicago, Milwaukee & St. Paul station at this place to consist of two additional wings and remodeling the interior. Two additions will also be made to the car repair shops 90 ft. x 200 ft., to cost about $100,000.

PARIS, TEXAS.—The Texas & Pacific, it is reported, is fixing a site for a brick station on which work is to be commenced at once, to cost $40,000.

PINE BLUFF, ARK.—The St. Louis, Iron Mountain & Southern is planning to put up a new passenger and freight station on the site of the present structure.

ROCHESTER, N. Y.—Plans are reported completed by the Buffalo, Rochester & Pittsburg for its new office building, to cost between $250,000 and $300,000.

THOMAS, W. VA.—The West Virginia Central & Pittsburg, it is reported, is planning to build extensive yards and shops here.

TULSA, IND. T.—The St. Louis & San Francisco is planning to put up a new passenger station here.

WASHINGTON, PA.—The Pittsburg, Cincinnati, Chicago & St. Louis, it is said, has decided to build a stone and brick passenger station at this place, to cost about $35,000.

WORCESTER, MASS.—The legislative committee on railroads has reported a bill to provide for a new union passenger station at Worcester to cost $350,000. The station is to be built by the Boston & Albany, which is to pay for the land, and the various railroads interested will jointly pay for the building.

YOUNGWOOD, PA.—The Pennsylvania, it is reported, will add 20 new stalls to its roundhouse at this place.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALTON, JACKSONVILLE & PEORIA.—It is reported that this company, which was incorporated in Illinois to build a line from Alton to Peoria, has been given a franchise for 50 years through Alton. Work is soon to be started on the road and it is expected to be in operation within one year. (See Construction Record.)

AMADOR MINING COMPANY.—A contract is reported let by this company to Ross & Co., Chicago, Ill., to build the Amador Railway from the new town of Amador, Mont., near Iron Mountain, on the Northern Pacific, up Cedar creek to the ore lands of this company. Several contracts which were previously let and on which work was under way have been taken over by Ross & Co.

ATLANTA, BIRMINGHAM & ATLANTIC.—A charter has been granted this company to build a line from Montezuma, Ga., to Birmingham, Ala., with a branch from Wedowee, Ala., to Atlanta. Most of the right of way is secured. H. M. Atkinson, of Atlanta, and capitalists of New York and Boston are interested. The road will eventually be consolidated with the Atlantic & Birmingham. The projected line is to be about 350 miles long.

BLACK HILLS TRACTION COMPANY.—Articles of incorporation have been filed by this company in South Dakota with a capital of $400,000 to build an electric road from Deadwood and Lead via Spearfish to Belle Fourche, a distance of 32 miles. The headquarters of the company are to be at Spearfish, and the incorporators include: Richard B. Hughes, Henry Keets, J. F. Summer, M. L. Brenn and Robert Crawford, all of Spearfish.

BROCKVILLE, WESTPORT & NORTHERN.—Preliminary surveys are reported completed for building a line from Westport, Ontario, the present terminus of the road, to French River, 250 miles.

CANON CITY & GREAT WESTERN.—Under this name a company has been incorporated in Colorado, with a capital of $1,000,000; Frank D. Heath, J. P. Fleishel, A. G. Forney, C. F. Willis, A. C. Griffin, Canon City, are interested.

CAPE BRETON (CANADIAN NORTHERN).—The Nova Scotia Legislature has granted a subsidy of $5,000 a mile to this company to complete a line from St. Peters to Louisburg, 35 miles. The company has also been authorized to build and operate a line from Grand Mere to Quebec; also to connect with the Quebec Bridge. The new line is intended to give the Canadian Northern a more direct route to the seaboard.

CENTRAL OF GEORGIA.—Announcement has been made that this company will extend the Columbus & Greenville line from Greenville, in Meriweather County, to Newman, in Coweta County, about 18 miles. This extension will give the Central a short line to Atlanta, through its connection with the Atlanta & West Point at Newnan and direct connection with Chattanooga, through Cedartown and Rome. The distance between Atlanta and Columbus by this route is only 107 miles, as against the Southern railway mileage of 127 via McDonough and Griffin, and 117 miles by way of the Fort Valley line to Williamson. The present line from Columbus to Greenville, 50 miles, is narrow gage. This will be made standard and about five miles saved by relocation.

CHICAGO GREAT WESTERN.—Preliminary surveys have been made by this company for an extension from Carroll to Sioux City, Iowa, about 80 miles. Work is to be commenced this summer.

CHICAGO, MILWAUKEE & ST. PAUL.—A contract has been given to Peter Shugart, of Des Moines, Iowa, for grading 50 miles of this road west from Armour, S. Dak. Work is to be commenced at once.

CHICAGO, ROCK ISLAND & PACIFIC.—It is reported that a bonus of $20,000 has been voted by the town of Granite, Okla. T., and rights of way granted for 10 miles to secure the extension of this road from Chattanooga westward through Snyder and Granite to Eric, 90 miles, running through the Wichita Mountain mineral fields.

COAST LINE RAILWAY (SOUTHERN PACIFIC).—Incorporation has been granted this company in California with a capital of $3,000,000 to build the proposed new coast line between San Francisco and Santa Cruz, together with a branch line 20 miles long from Pescadero to Boulder Creek. The directors include: William F. Herrin, William Hood, Peter F. Dunne, N. T. Smith and J. L. Willcutt.

DIXON FALLS & SOUTHWESTERN (ELECTRIC).—Rights of way, it is reported, are nearly all secured by this company for building an electric road from Dixon, Ill., to Rock Island, 60 miles. O. E. Mason, John Pippert and R. L. Leitch, of Rock Island, are interested.

DULUTH, VIRGINIA & RAINY LAKE.—This company, which operates a line in Minnesota about 27 miles long, it is reported, will build an extension from its northern terminus to Koochiching and Baudette, about 60 miles,

connecting at the latter point with the Canadian Northern.

ERIE.—This company's road, it is said, will be double-tracked from Ravenna, Ohio, west to Kent, six miles. The old Cleveland and Pittsburg Road, bought from the Pennsylvania Company, between Ravenna and Brady's Lake, will form a part of the second track line.

FORT WAYNE, VAN WERT & LIMA TRACTION.—A contract has been given by this company to the Cambria Steel Co. for the rails to be used in completing the section of the line of this road from Van Wert to Fort Wayne, a distance of about 33 miles.

GREAT NORTHERN.—According to reports, this company is planning to begin work on a line from Upper Similkameen river, which will be eventually carried to the British Columbia coast.

A cut-off, it is reported, will be built by this company between O'Neill, Neb., on the Willmar & Sioux Falls division of its road, and Thedford, on the Chicago, Burlington & Quincy, about 80 miles.

GREAT SOUTHERN.—This company proposes to build a line from The Dalles, Ore., to San Francisco and north through the State of Washington. John Heimrich and Julius L. Meyer, of Portland, are said to be President and Secretary.

GULF, HUTCHINSON & NORTHWESTERN.—New surveys are reported made by this company for building from La Crosse, Kan., to the Smoky Hill River, about 12 miles.

GUTHRIE, FAIRVIEW & WESTERN.—A director is reported as saying that this road will be built during the coming summer. Work will be under way along the entire line by the middle of May. The road is surveyed westward from Guthrie through Kingfisher and Watonga to Fairview, a distance of 100 miles. The greater part of the route lies through the Cimarron valley. The road will be a feeder to the Kansas City, Mexico & Orient. Kansas City capitalists, who are interested in the K. C., M. & O., are also backing this road. Horace Speed is a director.

HARTFORD & WORCESTER RAILWAY (ELECTRIC).—This company has recently been granted a charter in Connecticut to build an electric road from Rockville, the northern terminus of the Hartford, Manchester & Rockville Tramway, northeastwardly through Stafford to Cherry Valley, Mass., near Worcester, 38 miles. This is a project of the Boston & Worcester, for a through line from Boston to Hartford. Construction work will be begun shortly.

HOUSTON, BEAUMONT & RED RIVER.—A charter has been granted this company in Texas to build a line in Harris, Liberty, Hardin, Jefferson, Orange and Newton counties; and arrangements for the commencement of the work are already under way. Nearly all the right of way has been secured. The new line would almost parallel the Southern Pacific. The officers are: J. O. Ross, President; H. W. Cortes, Treasurer, and Ed Kennedy, Secretary. The rest of the incorporators include R. C. Duff, of Beaumont, and W. R. Eckhart and Edgar Watkins, of Houston.

ILLINOIS CENTRAL.—Surveys are reported being made by this company for a new line from Jackson, Tenn., via Sheffield to Birmingham, Ala., about 230 miles.

JAMES BAY.—The Railway Committee of the Canadian House of Commons has reported the bill authorizing this company to build extensions from Toronto to Ottawa and thence to Montreal. The line of the proposed road crosses the Ottawa River at Hawkesbury, and thence runs down the north shore to the Island of Montreal where it is proposed to build two branches into the city. The bill also provides for extensions from French River to Ottawa and from Sudbury to Port Arthur to connect with the Canadian Northern.

KANSAS CITY & LEAVENWORTH.—This road operating from Kansas City to Leavenworth, 30 miles, is reported sold to Clarence S. McClellan, of Mt. Vernon, N. Y., who represents an eastern syndicate. The new owners it is said will extend the line to Atchison, Kan., and St. Joseph, Mo.

KANSAS CITY, NEVADA & SPRINGFIELD.—The preliminary survey of this proposed line from Kansas City to Springfield, Mo., has been completed. The line as surveyed passes through a country rich in minerals and agricultural products. President T. P. McDonough states that this proposed road is independent of any established railroad, and that he has sufficient capital to carry the project through provided he can make satisfactory terms with the towns through which it will pass.

KEWEENAW CENTRAL.—According to reports, this company has begun a permanent survey for building a road from Calumet, Mich., to Lac Labelle, 30 miles.

KOOTENAY CENTRAL.—Surveys are reported completed for a permanent line on the east side of the Columbia River from Golden, B. C., to Windemere, along Windemere Lake to Fairmont Springs, and along the Columbia River to Canal Flat, about 100 miles.

LAKE SHORE & MICHIGAN SOUTHERN.—An officer denies the report that this company has secured rights of way for an extension from Franklin, Pa., up Mill creek to Falls creek.

LIBERTY WHITE.—An extension is proposed to be built westerly from the present terminus of this road, which is operated from Liberty to McComb, Miss., 24 miles, to Columbia, 40 miles.

LOUISIANA & WESTERN (SOUTHERN PACIFIC).—According to press reports, surveys are being made for an extension of this road from Lake Charles to a rich timber territory on the Calcasieu river, about 15 miles north of Leesville, La., 75 miles.

MAINE ROADS.—Application is being made by a company with headquarters at Lewiston for a charter to build a road to be operated by electricity or compressed air from Lewiston to Portland through the towns of New Gloucester, Gray, Cumberland and Falmouth, about 30 miles. Winfield S. Libby, Harry M. Dingley, J. E. Parkhurst, J. F. Boothby and John H. Morill, all of Lewiston, are said to be interested. These towns are at present connected by an electric road via Brunswick, a distance of over 50 miles.

MASON CITY & FORT DODGE (CHICAGO GREAT WESTERN).—The recent issue of $12,000,000 of bonds by the Chicago Great Western will be used for building the Mason City & Fort Dodge from a point southwest of Des Moines, Iowa, on the Kansas City, St. Joseph & Council Bluffs, northwest to Carroll, on the Omaha line near Fort Dodge, and continuing northwest to Sioux City.

MEDFORD & CRATER LAKE.—Surveys are reported made and rights of way secured for building 12 miles of the proposed 32 miles of this road. Contracts for grading between Medford and Eagle Point have been let to Charles Ewing, of Medford, and others will be let at once. A. A. Davis, Medford, Ore., is Pres., and J. A. McCall, Chief Engineer.

MOBILE, JACKSON & KANSAS CITY.—Financial arrangements, it is reported, have been completed by this road for building a branch, on which work is to be started next month, from Meridian, Miss., southwesterly 30 miles, touching the main line at a point near Montrose, in Jasper County. A branch is also projected northwesterly from Meridian to a point on the main line at Philadelphia, in Neshoba County, Miss., about 35 miles.

MONROE & NORTHAMPTON (ELECTRIC).—An officer writes that this company expects to begin work at once on its proposed electric road from Stroudsburg, Pa., through Delaware Water Gap, North Bangor and Roseta to Bangor, 15 miles, for which contracts have been let. The work includes the building of one steel bridge at Stroudsburg. R. F. Schaeffer, Bangor, Pa., is President, and William McLean, Philadelphia, Chief Engineer.

NORFOLK & WESTERN.—This company denies that it is planning to build an extension of the Big Stony Railway through Giles County.

NORTHERN CENTRAL (PENNSYLVANIA).—An officer writes that the $1,500,000 recently authorized by the directors for improvements will be used mostly to complete the four tracking of existing lines, and that no new lines are under consideration.

OHIO & MARSHALL COUNTY.—A charter has been granted this company, with a capital of $230,000, in West Virginia, to build a railroad from Benwood through Wheeling to the western boundary line of Pennsylvania in Marshall County. The incorporators, A. J. Cochran, G. L. Hibbs, Thomas M. Benner, Joseph E. Barnes and I. W. Semans, all of Pittsburg and Uniontown, with J. V. Thompson, own practically all the coal in Marshall County from the Ohio river to the Wetzel County line. The road is proposed for the development of this property, and its natural route will be along Big Wheeling creek, with possible connections with the Wheeling Terminal at Benwood or in Wheeling.

OREGON & SOUTHEASTERN.—An officer writes that this company, which was organized in Oregon, has 20 miles of track laid on its proposed steam road to run from Cottage Grove to Wildwood, in Lane County, at the junction of the Southern Pacific. The company will build, with its own forces, eight miles additional to complete the line. The work is light and the steepest grade will be 1 per cent. G. B. Hengen, 15 William street, New York, is President.

PENNSYLVANIA LINES WEST.—The improvements to be made by this company this year include the elimination of grade crossings and building six miles of second track on the Indianapolis division. A second track is also to be laid between Florence and Wilberforce, Ohio, at a cost of $330,000. Work is to be started at once.

An officer writes that the work of depressing the tracks in Allegheny City, Pa., begins at Ridge avenue and runs to a point 700 ft. west of Washington avenue, a distance of about 5,000 ft. A contract for the grading and masonry has been let to the Columbia Contracting Co., Pittsburg, Pa., and the work is now in progress. There will be three overhead highway bridges, which have been contracted for.

PENNSYLVANIA LINES WEST (SOUTHWEST SYSTEM).—In connection with the work on this line between Bulger and Burgettstown an officer writes that contracts for grading and masonry have been given to Chas. A. Sims & Co., of Philadelphia, and that work will soon be commenced. The maximum curvature will be reduced from 6 deg. to 2 deg. 30 min. There will be one deep cut about 300 ft. long. One 60-ft. arch will be extended and two undergrade crossings are to be built. The work includes the removal of 250,000 cubic yards of earth.

PITTSBURG, CLEVELAND & TOLEDO.—A certificate has been filed in Ohio by this company, authorizing it to build a branch from its main line near Girard, to a connection with the Pittsburg, Painesville & Fairport Railroad in Liberty Township.

PUGET SOUND EASTERN.—A charter has been granted to this company in Washington to build a line from Chehalis to British Columbia, and east to the Idaho line. One of the incorporators is reported as saying that a line will be built from North Yakima through Chehalis to tidewater at Olympia, traversing a rich agricultural and timber country, in which there are extensive coal mines. The company is said to have secured the rights of way of the old Chehalis Eastern. The incorporators are C. W. Taylor, of Detroit; H. W. Holmes, A. E. Thompson, John Schram and others.

PORT ARTHUR, DULUTH & WESTERN (CANADIAN NORTHERN).—An extension is proposed from the present southern terminus of this road in the Gunflint country to Ely, on the Vermilion iron range in Minnesota.

RIO GRANDE, SIERRA MADRE & PACIFIC.—A contract, it is reported, has been let by this

company to J. H. Flick & Co., of Kansas City, for building the first 80 miles of its proposed extension. (See Construction Record.)

SAN PEDRO, LOS ANGELES & SALT LAKE.—This road was opened April 18 from Salt Lake through to Los Angeles. Regular trains will be put on soon after May 1.

A director of this road is reported as saying that a line will be built to Bullfrog, a new mining camp in Nevada, from the nearest point on its line in Southern Nevada at Las Vegas, about 120 miles.

SOUTHERN.—According to reports, this company is planning to build a cut-off from Pioneer to Winfield, Tenn., on the Cincinnati Southern, about 15 miles, which would reduce the distance to Cincinnati over 30 miles.

Surveys, it is reported, are being made by this company for double-tracking its road between Knoxville, Tenn., and Morristown, 42 miles.

A contract has been let by this company to William J. Oliver & Co. for building the tunnel through Lookout Mountain on its proposed extension from Chattanooga, Tenn., to Stevenson, Ala. It provides that the work shall be completed within 18 months from the time it is begun. The tunnel is to start at a point about 100 ft. south of the Nashville, Chattanooga & St. Louis bridge over Chattanooga creek, and run through the mountain parallel to the N., C. & St. L. track. It will be about 3,500 ft. long.

SOUTHERN INDIANA.—An officer writes that surveys are being made and rights of way secured for building an extension from a point on its road at Blackhawk, 11 miles south of Terre Haute, to Indianapolis, 75 miles. The maximum grade will be .6 per cent. About 50 acres of land, it is said, have been bought in the city of Indianapolis for terminals.

VIRGINIA ROADS (ELECTRIC).—Capitalists of Big Stone Gap, Va., propose to build 100 miles of electric roads and it is said that they have begun surveys. The objective points are Appalachia, Stonega, Norton, Wise, Toms Creek and Dorchester. Valuable mineral and timber property will be reached by the proposed lines.

WABASH-PITTSBURG TERMINAL.—A contract, it is reported, has been given by this company to the Friday Construction Co., of Pittsburg, for the concrete work on the elevated freight line on the South Side at Pittsburg. This company also has the contract for the elevated line on Duquesne Way, Pittsburg.

WATERLOO, CEDAR FALLS & NORTHERN (ELECTRIC).—Announcement has been made by President Cass, of this company, that negotiations are pending for the consolidation of the road with the Mason City & Clear Lake Traction Co.; also for the construction of a connecting line from Mason City southeasterly to Waverly, 50 miles, and an extension of 20 miles from Sumner, the present terminus of the former company, to West Union, Iowa. The consolidated company will have 126 miles of interurban tracks and 20 miles of street railway.

WHITE RIVER VALLEY.—A contract is reported let by this company to McIntosh Bros., of Milwaukee, for the construction of the new line from Chamberlain, S. Dak., to a point in the center of Lyman County in the same state. Only 75 miles of track will be built at this time, but later it is proposed to extend to Deadwood in the Black Hills, 300 miles. The road is to be in operation by Nov. 1.

WILDMAN CENTRAL & WICHITA MOUNTAIN.—A charter has been granted this company in Oklahoma with a capital of $200,000 to build a line through the mining districts of the Wichita Mountains in Oklahoma. R. Burge, of Fort Worth, and E. Tucker, of Dallas, Tex., are interested.

WISCONSIN ROADS.—Surveys are reported being made for a new railroad from Madison, Wis., to Fond du Lac, about 75 miles. Much right of way has been secured. Governor Myron T. Herrick, of Ohio, is said to be representing the capitalists who are to finance the road.

YAZOO & MISSISSIPPI VALLEY.—Surveys are reported being made for a new line from Valley Park, on the main line of the Yazoo & Mississippi Valley, to Silver City, on the Yazoo branch, about 42 miles.

RAILROAD CORPORATION NEWS.

ANN ARBOR.—The control of this road, it is announced, is now held by Rudolph Kleybolte & Co., of Cincinnati. They have acquired over two-thirds of the $3,250,000 common stock and over three-fourths of the $1,000,000 preferred stock. This stock was purchased from George J. Gould, Joseph Ramsey, Jr., and the St. Louis Union Trust Co., of St. Louis, who have been operating the property in the interests of the Gould system.

ATLANTA & BIRMINGHAM AIR LINE.—The directors of this road, which is the Birmingham extension of the Seaboard Air Line, have been authorized to issue $5,000,000 bonds.

BALTIMORE & OHIO.—This company's statement for the month of March shows gross earnings of $6,233,789 in 1905, against $5,844,377 in 1904, an increase of $380,412. Expenses at the same time increased $175,209, leaving net earnings in 1905 of $2,000,096, an increase of $214,203 over the 1904 figure. For the nine months ended March 31, gross earnings were $53,866,202 in 1905, against $52,151,053 in 1904, an increase of $1,715,149. Expenses increased $440,981, leaving net earnings of $13,313,009 in 1905, an increase of $1,274,168 over last year's figure. This statement includes the Baltimore & Ohio Southwestern.

BRATTLEBORO & WHITEHALL.—See West River.

CENTRAL VERMONT.—See West River.

CHICAGO & EASTERN ILLINOIS.—A special meeting of the stockholders has been called for June 29 to vote on issuing $55,000,000 4 per cent. 50-year refunding and improvement mortgage bonds redeemable on 60 days' notice at 102½ and interest. Of this amount $5,000,000 is to be used at once for improvements and additions, and $34,626,000 for refunding purposes.

COAHUILA & PACIFIC.—See Mexican Central below.

CONNECTICUT RIVER.—The shareholders of this company, leased to the Boston & Maine, will on April 29 vote on increasing the capital stock by such an amount as may be necessary to build a short connection with the Fitchburg in the town of Deerfield, Mass.

FLORIDA WEST SHORE.—Otto E. Lohrke and Rosen & Co. are offering at 102½ a portion of the first-mortgage 5 per cent. gold bonds of 1934 of this company, guaranteed by the Seaboard Air Line. The company owns 60 miles of line from Turkey Creek, on the Seaboard Air Line, southwest to Sarasota, on the Gulf of Mexico, with branch lines to Terra Ceia and Lemon. The bonds are authorized to the amount of $2,000,000 ($12,000 per mile), of which $712,000 are outstanding. The balance is reserved to buy or build additional track. On June 1, 1903, a traffic contract was made with the Seaboard Air Line by which that road has become the preferred connection of this company and agrees to guarantee the bonds now outstanding.

GREAT NORTHERN.—See Northern Securities below.

MASSACHUSETTS ELECTRIC COMPANIES.—The Massachusetts Railroad Commission has authorized the Boston & Northern and the Old Colony Street Railway Companies each to issue $500,000 capital stock at par to provide for debts incurred for additions and improvements and to pay for further improvements. The former company will reserve $100,000 and the Old Colony Company $75,000 for improvements, the remainder of the amounts being for past debts. Both companies are subsidiaries of the Massachusetts Electric Companies.

MEXICAN CENTRAL.—On May 3 the shareholders will vote on authorizing an issue of $625,000 additional capital stock in part payment for the bonds, securities and claims of the Coahuila & Pacific, which has been bought by the Board of Directors.

NORTHERN PACIFIC.—See Northern Securities below.

NORTHERN SECURITIES.—The stock transfer books of this company having closed April 18 for the purpose of receiving deposits of the stock under the plan for distributing pro rata the holdings of stock of the Northern Pacific and Great Northern, stockholders have been notified to deposit their stock at the New York office of the company. The stockholders are to deposit their entire holdings, in return for 99 per cent. of which they will receive (per $100 share) $30.17 of Great Northern stock and $39.27 of Northern Pacific stock. The 1 per cent. remaining will be exchanged for $1 in Northern Securities "stubs," which are selling at about 800. As soon as the stock has been transferred, the Great Northern and Northern Pacific will pay the dividends which have been declared but not paid, pending the termination of the litigation, amounting in each case to 7 per cent.

SEABOARD AIR LINE.—See Atlanta & Birmingham Air Line and Florida West Shore above.

SPRINGFIELD STREET RAILWAY.—It is announced that a majority of the stock of this company has been deposited under the agreement with the New York, New Haven & Hartford made through Lee, Higginson & Co. Nearly $1,800,000 of the $1,958,400 capital stock is reported to have been deposited.

UNITED RAILWAYS OF ST. LOUIS.—Harvey Fisk & Sons, of New York, and the Mercantile Trust Co., of St. Louis, are offering at 97½ about $1,000,000 St. Louis Transit 5 per cent. improvement bonds. The authorized issue is $10,000,000. Control of the United Railways has recently been acquired by the North American Company.

WABASH.—This company plans to issue $7,000,000 short-term notes, instead of $10,000,000, as was expected. The proceeds are to be devoted to the Wabash-Pittsburg Terminal and the Pittsburg Terminal Railroad & Coal Co. The additional $3,000,000 will be provided for by part of the proposed issue of $50,000,000 Wheeling & Lake Erie bonds. The Wabash 5 per cent. notes are to be secured by a deposit of $1,200,000 par value of the Pacific Express Co., and by stock of the Belt Railway of Chicago, and of the American Refrigerator Transit Co. The present annual income on this collateral is $450,000, while the interest on the notes amounts to $350,000. The notes will probably be sold to a syndicate managed by W. A. Read & Co. and G. P. Butler & Brother.

WESTERN PACIFIC.—A syndicate headed by Blair & Co., William A. Read & Co. and William Salomon & Co., have underwritten the first-mortgage bonds of this road for the building and equipment of the line from Salt Lake City to San Francisco. These are 30-year 5 per cent. bonds and the authorized issue is $50,000,000.

WEST RIVER.—The Brattleboro & Whitehall, a narrow gage line leased to the Central Vermont, which runs from Brattleboro, Vt., northwest to South Londonderry, 36 miles, has been reorganized under the name of the West River Railroad, with $100,000 capital stock, and Walter C. Noyes, of Old Lyme, Conn., has been elected President. The reorganization will not affect the lease to the Central Vermont.

WHEELING & LAKE ERIE.—The stockholders of this company will vote on May 20 on making a general mortgage to secure $50,000,000 4 per cent. 50-year gold bonds.

GENERAL NEWS SECTION

NOTES.

The Chicago, Rock Island & Pacific is to build, at East Moline, Ill., a hotel for the use of its employees, with a capacity of about 150 guests.

At Los Angeles, April 25, suit was begun in the United States District Court to enforce obedience by the railroads to the order of the Interstate Commerce Commission regulating rates on oranges from California to points east of the Missouri river.

The Railroad Commission of Texas has ordered a reduction in the maximum rate allowed to be charged by the railroads on shipments of grain going over two or more railroads; the maximum has hitherto been 17.5 cents; this is reduced to 15 cents.

The Southern Railway has lately appropriated $40,000 for the erection of buildings for the use of the Young Men's Christian Association at division points, and has subscribed $5,000 to the fund of the Young Men's Christian Association in the city of Washington, D. C.

In the United States Court at Pensacola, Fla., April 30, on a suit filed by the principal railroads of the state, an injunction was issued forbidding the enforcement of a reduction in the rates for the transportation of lumber ordered by the Florida State Railroad Commission.

The Interborough Rapid Transit Company, operating the subway and elevated railways of Manhattan, New York City, has increased the pay of first-year gate men from $1.40 a day to $1.50 a day. All first-year guards on the pay rolls at the beginning of this month were advanced to the second-year rate, $1.70 a day.

A special officers' train, consisting of an engine and four heavy cars, was run over the Pennsylvania Railroad from Pittsburg to Philadelphia, on April 30, in 6 hours and 25 minutes, the distance being 353 miles. It is estimated that the stops consumed 35 minutes. The train was made up and started on short notice.

In the United States Court at Cleveland, Ohio, April 26, a suit was filed by the Government against the Baltimore & Ohio for a violation of the law requiring at least half the cars in every train to be equipped with power brakes and connected with the engine for use. Of a certain train of 25 cars only eight had air-brakes working.

A Chicago paper says that the Chicago & Alton will hereafter allow engineers to earn only $140 a month and firemen only $80. When business is very heavy enginemen (paid by the trip) have been making as high as $200 a month, while the extra enginemen have earned very little. The new rule is designed to enable the extra men to earn living wages in dull seasons.

The State Railroad Commission of Kansas is to give a public hearing on a complaint that sleeping car berths are sold at lower rates in other states than in Kansas. The new railroad law of Kansas gives the Commission power over sleeping cars and their management, but it is said that the Pullman Company will probably contest the law as not applying to a company which, like itself, is claimed to be not a common carrier.

Among the railroad officers who have testified before the Senate Interstate Commerce Committee at Washington, during the past week are Mr. George R. Peck, General Counsel of the Chicago, Milwaukee & St. Paul, Mr. Hugh L. Bond, Second Vice-President of the Baltimore & Ohio, and Mr. James C. Lincoln, General Freight Agent Missouri Pacific.

Mr. W. D. Hines, of Louisville, continuing his statement begun last week, with a view to showing the magnitude of the task of making rates for the railroads of the country and the impossibility of doing it through a Government commission, said that 66 officials and 25 clerks were required to do this work on the Louisville & Nashville alone. On the southern classification 100 men are engaged all the time in making adjustments. Within five years these men have made 12,451 changes; and every change, no matter how small, is "vital to some industry" and must be made quickly. Mr. Hines said that out of 120 changes in freight rates made in this country in 1904, 103 were reductions.

A committee of citizens of St. Louis, large and apparently strong, appointed by the Mayor, is investigating traffic conditions with a view to reducing the cost of transferring freight across the river. One proposition before the committee is to build a third bridge, with a view to having free competition, and the city government has made a liberal appropriation to employ expert engineers to assist the committee. Members of the committee went to Springfield and appeared before the Illinois Legislature to urge their demand for a free bridge. In this the people of St. Louis were, however, opposed by those of East St. Louis, who fear that the cheapening of transit across the river will be a disadvantage to East St. Louis as a railroad center.

Complaints Against the Suez Canal Management.

British ship owners seem very much dissatisfied with their treatment by the Suez Canal Company, so much so that schemes for rival enterprises are again being discussed in British newspapers. In 1883 there was a similar outcry against the Suez Canal monopoly, and three sets of plans were drawn up—one for a fresh-water canal from Alexandria to Cairo and thence via Tel-el-Kebir to Suez; another for a canal from Alexandria to Mansura and Ismailia and thence to Suez, and the third for a canal parallel to the existing one. However, the British Government appeared at that time to have publicly conceded the exclusive rights to a waterway across the Isthmus of Suez to the de Lesseps organization. This did not pacify the disgruntled shipowners, and as a new canal could not be a success without the cordial support of British shipping interests, M. de Lesseps repaired to England and negotiated with the shipowners. The result was that the two parties agreed to what is called "the London program," with the conclusion of which the agitation apparently subsided.

In British shipping circles it is held that "the London program" was based on a distinct understanding that the canal company would gradually reduce the rates on ships from the $2.61 per ton, originally charged, and that when the company's dividend reached 25 per cent. no higher dividend was to be paid until the dues were reduced to 96.5 cents per ton. It is further claimed that last year a dividend of 26 per cent. was paid while the dues were $1.69 per ton.

In this connection, Suez Canal transit receipts for 1901 amounted to $19,515,116 (an increase over 1900 of $1,897,889), and were higher than in any previous year since the opening of the route. During the 12 months ended Dec. 31, 1904, 4,257 ships entered the canal, and there were received in dues $22,524,540, an increase of $2,411,610 over 1903, in which year the number of ships passing through the canal was 3,775. The growth of the Suez Canal business is illustrated in the statement that the number of ships using the canal in the years 1899, 1900, 1901, 1902, 1903, and 1904 were 3,607, 3,441, 3,699, 3,708, 3,775, and 4,257. There are other complaints by the shipping interests particularly in regard to arbitrary tonnage measurements, which include in the total tonnage, spaces on deck available for cargo, but not so used.

Sir Theodore Angier, of the shipping firm of Messrs. Angier Brothers, recently said in a public interview:

We are not the helpless creatures the canal people think we are, and I believe that, even by their own action, they are bringing about their own defeat. The result will be that, even if no other canal is cut, shipowners will alter their style of vessels, and will build those which, while they could not pay going through the canal, will do so if sent round the Cape.

According to the London *Standard*, the Hamburg-American Company has joined the opposition to the Suez Canal Company, and issued a statement of grievances, concluding as follows:

The management of the Suez Canal is such that it exasperates the whole shipping world. If the present agitation in favor of a second canal results in the reduction of the tolls of the existing canal, the shipping trade with the Far East will be greatly facilitated. After the conclusion of the war between Russia and Japan there will be great opportunities for developing the trade with Far Eastern countries. If, however, the Suez Canal continues to be managed as at present, both Russia, with the Trans-Siberian Railroad (the efficiency of which has been greatly increased by the war), and America, with her direct sea route, will be far more favorably situated than the European countries whose way lies through the canal.—*U. S. Consular Report.*

New York City Freight Business of the N. Y. C.

The New York Central & Hudson River, according to the company's statement, handled during 1904 at its 13 New York tide water terminals 7,923,062 tons of inbound and outbound freight and 1,761,397 loaded and empty cars. The marine department carried by lighter or barge during the year 1,121,951 tons of merchandise and 17,678,152 bushels of grain, and by car float 235,680 cars of merchandise.

Automatic Stop Tried on the Fort Wayne.

On Monday last there was a test on the Pittsburg, Fort Wayne & Chicago, near Pittsburg, of an automatic train stopping device which not only applies the brakes but shuts off steam. A section of track five miles long has been equipped with the necessary appa-

ratus and there are seven block sections in the five miles. A special train was run consisting of a locomotive and one car, the car being fitted with a duplicate of the apparatus in the locomotive to facilitate inspection by the visitors. A large number of railroad men witnessed the test.

The McGrath Pneumatic Flue Welder.

The McGrath pneumatic flue welder was designed to expedite and cheapen the welding and swaging of locomotive boiler flues, the designer, a practical railroad man, preferring a hammered to a rolled weld.

The machine in Fig. 1 consists of a double-cylinder pneumatic hammer set on a base, taking up altogether less than 2 ft. square of floor space, and standing about 4½ ft. high. The frame and the double cylinder are a single steel casting. The piston is $3^{3}/_{16}$ in. at its largest diameter and is made of solid tool steel hardened and ground to fit the cylinder. It is tapered 6 deg. on each side, leaving it parallel to the cylinder sides for 1½ in. Below the head it is shouldered down to 2⅝ in. and at the lower (outer) end it is attached to the top die, being held with a key. The lower die is held rigid in the steel frame. The dies are bored to the outside size of the flue, allowing for expansion when hot, while the mandrel is nearly the size of the inside of the tube and is provided with a collar to suit the length of the safe-ends required. The air is admitted through a ¾-in. pipe connected through the back of the valve box inside of the base. This valve box has two independent valves which connect with a foot lever. Each side of the machine thus works independently, so that while welding is being done the side used for swaging is idle, and vice versa.

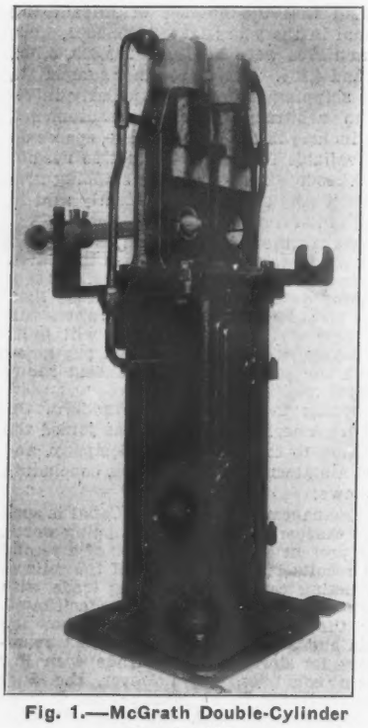


Fig. 1.—McGrath Double-Cylinder Flue-Welder.

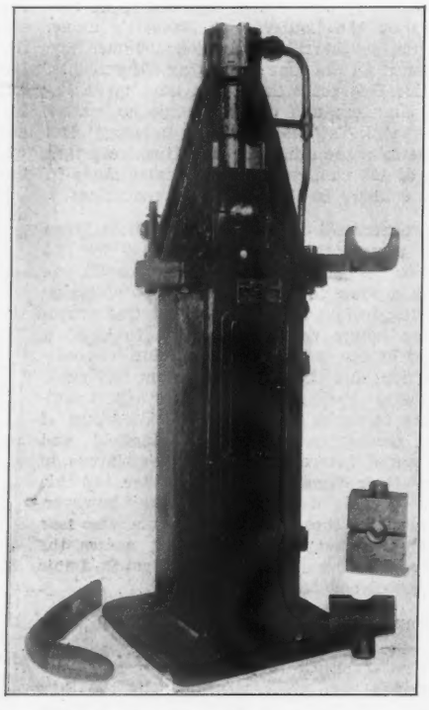


Fig. 2.—McGrath Single-Cylinder Flue-Welder.

In operating the hammer, all that is necessary is to press on the foot lever. This admits the air through the side pipe under the shoulder of the piston, forcing it to the top of the cylinder and pushing back small valves which project into the cylinder. These admit air above the piston, and its area being larger than that of the shoulder below, the piston is forced downward until the dies come together. A 1-in. hole extends from the top of the piston to the small port holes visible in the rod just above the die. Exhaust occurs through these holes as soon as they come below the cylinder. The instant the blow is delivered, the piston is again carried up by the air pressure which is always under the shoulder of the piston when the foot valve is open.

With 100 lbs. air pressure the piston will deliver 2,000 blows or more a minute. As the top die and piston together weigh about 40 lbs., the hammer will strike upward of thirty-three 40-lb. blows a second, which is amply sufficient to weld flues. The operation of welding and swaging can be done in five seconds, it is claimed. The frame is large enough to allow the dies to be bored out to weld any size of flue up to 4½ in., and by having a long mandrel, placing the welder behind the furnace, and allowing the flue to project through the dies, there is no limit to the length of end that may be welded.

The Hammond Iron Works, Warren, Pa., recently completed with McGrath welders one of the largest flue welding contracts ever attempted, having welded safe-ends on about 16,000 tubes 4 in. in diameter. These safe-ends varied in length from 2 ft. to 4 ft. Out of this quantity of tubes less than 100 were lost, which is a very small percentage. On an average of 100 tubes a day were welded, some days running as high as 150. One large railroad has recently concentrated all its flue welding at one point, and is doing it with one McGrath welder. The work formerly done at three points with three different machines is now done by this one machine. The master mechanic having charge of this work recently reported that out of a lot of 1,430 flues welded, only three were defective from leaks.

The double-cylinder machine may have one side equipped for scarfing flues. Fig. 2 shows a single-cylinder machine. A double-cylinder machine, performing the operations of scarfing, welding and swaging, will be on exhibition at the International Railway Congress. The Draper Manufacturing Company, Port Huron, Mich., is the sole maker.

Freight Rates in Missouri.

The Missouri State Railroad Commission has completed its tabulation of freight rates as fixed by the new maximum freight rates law which goes into effect June 17. On car load lots of grain, flour, lime, salt, cement, lumber, lath and shingles, the rate is five cents per 100 lbs. for 25 miles and 5 mills added for each additional 25 miles. On agricultural implements, furniture and wagons, c. l. 7 cts. per 100 lbs. for the first 25 miles and one cent for each addition 25 miles. On live stock per standard car load, $6 for 25 miles, $9 for 50 miles, $11 for 75 to 87 miles, $13 for 100 to 112 miles, and so on, $2 being added for each 25 miles. On stone, crushed rock, sand and brick, c. l. 2 cents for 10 miles, 3 cents for 20 miles and 2½ mills for each additional 10 miles.

The railroads of the state have held a conference, at which Vice-President Darius Miller, of the Burlington, presided, and they propose to lay before the Commission a statement showing the serious reduction in income which will be caused by the adoption of the proposed low rates.

Manufacturing and Business.

The New York offices of the Ashton Valve Company have been moved to 128 Liberty street.

The Snare & Triest Company, Contracting Engineers, formerly at 39 Cortlandt street, has moved its offices to 143 Liberty street, New York.

The Pilling Air Engine Co., Detroit, Mich., has succeeded the Pilling Air Engine Works, which was located at Bucyrus, Ohio. Mr. J. L. Pilling is Vice-President and General Manager.

The Atlas Railway Supply Co., Chicago, announces that C. D. Porterfield, Eastern Representative, 150 Nassau street, New York, is no longer connected with the company and the eastern office has been discontinued temporarily.

The American Water Softener Co., Philadelphia, Pa., reports an order from the Hocking Valley, which includes a water softening plant to be installed at their Columbus shops, with a capacity of 25,000 gallons an hour, or 600,000 gallons a day.

A contract has been given by the New York State Superintendent of Public Works, N. V. V. Franchot, to F. A. Maselli & Co., of Pittsburg, Pa., at their bid of $1,005,982 for building a section of the barge canal at North Greece, west of Rochester, N. Y.

The Armour Institute of Technology, Chicago, announces a summer session from June 26 to August 4. Courses are offered in mechanical, electrical, telephone, civil and chemical engineering, and in drawing, shop work, manual training, mathematics and physics.

Bids are wanted at the office of the Purchasing Agent of the Isthmian Canal Commission, Washington, D. C., May 16, for furnishing one 10-ton and one 20-ton locomotive crane. Particulars may be obtained at the above address or at the office of the Assistant Purchasing Agent, 24 State street, New York.

The American Steel Foundries has been awarded a contract by the Norfolk & Western for body and truck bolsters for 4,000 cars of different designs and capacities. These cars will be built partly at the Roanoke shops of the railroad and partly by outside concerns. The bolsters for the entire lot of cars will be cast steel.

A contract is reported let to the Barnett-

Record Co., of Minneapolis, Minn., for building large coal and ore docks at Port Arthur, Ont. The docks will be used to handle ore from Atikokan iron deposits in Ontario and will be equipped with modern machinery, having a capacity of 300,000 tons annually.

Negotiations are reported under way by the Pacific Coast Steel Co. for building a large steel plant to cost $500,000 at Richmond Beach, about 15 miles north of Seattle, Wash., where the company is trying to secure a 120-acre site with a quarter of a mile of water front. Walter Kennedy is President of the company. Pittsburg capitalists are said to be back of the company.

The Buda Foundry & Manufacturing Company has added to their force of traveling representatives, Mr. Jas. H. Bannerman, who was formerly Mechanical Superintendent of the Tennessee Central. Mr. Bannerman will represent chiefly the metal department of the Buda Company and demonstrate to railroad mechanical departments the advantages of some of the new compositions recently placed on the market.

The Electro-Dynamic Company, Bayonne, N. J., will have an exhibit in spaces 1 and 2 of section "O" in the main exhibition building at the International Railway Congress, Washington, D. C. The exhibition will consist of a number of inter-pole variable speed motors, and will include a "5—S" type motor which will be shown running under varying conditions of speed from 275 to 1,100 r.p.m., and all loads from no load to 100 per cent. over load.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company the old board, consisting of Edward F. C. Young, John A. Walker, Edward L. Young, William Murray, George T. Smith, Joseph D. Bedle and George E. Long, was unanimously re-elected. The board of directors re-elected the former officers, namely, Edw. F. C. Young, President; John A. Walker, Vice-President and Treasurer; George E. Long, Secretary. Judge Joseph D. Bedle was also re-elected as counsel.

The Miller-Collins Company, 1133 Broadway, New York, recently incorporated by S. Fischer Miller and D. C. Newman Collins, has been awarded the general contract for the new factory building of Messrs. Hanan & Son, in Brooklyn, N. Y. H. S. Kissam is the architect. The building is to be five stories high, with 200 ft. x 100 ft. of reinforced steel concrete construction and brick exterior walls, the approximate cost of the whole to be $175,000. The Miller-Collins Company is in the market for prices on all kinds of building material.

The Climax Stock Guard Company, Chicago, state that its sales for the month of April included 33 carloads of the Climax "Clay" cattle guards. These were shipped to the following railroads: Wisconsin & Michigan Railroad Co., New York Central & Hudson River R. R., Long Island R. R., Morgantown & Kingwood, Pennsylvania Railroad, Washington & Canonsburg Electric Line, Warren & Jamestown Street Railway, Portsmouth, Dover & York Electric R. R. Co., and Waterloo, Cedar Falls & Northern, and the Chicago & Alton.

The Scullin-Gallagher Iron & Steel Co., St. Louis, Mo., is asking bids for building a new foundry and equipping it. The buildings to be put up will be of steel, two 400 ft. x 75 ft. each, one 400 ft. x 65 ft., and one 200 ft. x 48 ft., to contain four 25-ton basic open-hearth furnaces, three 30-ton electric traveling cranes (75-ft. span), two 15-ton electric traveling cranes (75-ft. span), two 10-ton electric traveling cranes (65-ft. span), and one charging machine, all the machinery to be electrically driven, for which an 800 h.p. boiler and one direct connected generator and Corliss engine will be installed.

The National Electric Co., Milwaukee, Wis., announces the resignations of F. G. Bigelow, Director and Chairman of the Board; S. W. Watkins, Director and President; F. C. Randall, Director, Vice-President and General Manager; Gordon Bigelow, Director. The vacancies were filled by the election of John I. Beggs, J. H. Van Dyke, Jr., Chas. F. Pfister and Frederic Vogel, Jr., the first two being elected President and Vice-President, respectively. The business of the company will be actively continued and all contracts now on the books promptly completed. The indebtedness of the company is now being ascertained by the new management and as soon as it is fully known a meeting of the creditors will be called to consider the best course to be pursued for the protection of all creditors and for the future welfare and progress of the company.

Iron and Steel.

The Republic Iron & Steel Co., Youngstown, Ohio, is now in a position to roll rails; but its output will be limited, as the mill makes sheet bars and billets as well as rails.

Heavy purchases of rails are still being made by the railroads. One of the southwest roads has ordered 9,000 tons and expects to order 15,000 tons more. An Oklahoma road has bought 5,000 tons, and 15,000 tons are wanted for Cuban railroads.

The orders of the American Bridge Co. reached a total of about 75,000 tons for the month of April. The highest single month was May, 1903, 101,000 tons. This company has orders for 8,000 tons of steel to be used in building the bridge at Naugatuck for the New York, New Haven & Hartford. The St. Louis & San Francisco has ordered about 3,000 tons, and 1,750 tons has been ordered for a building in Pittsburg.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

Railway Club of Pittsburg.

At the regular meeting of this club April 28, a paper on "Locomotive Water Space Stays" by B. E. D. Stafford was read.

American Society of Civil Engineers.

At the regular business meeting of this society May 3, there were papers on "Roundhouse Framing" by R. D. Coombs, and on "Foundations" by L. L. Buck. Both these papers are printed in the April number of "Proceedings."

Engineers' Club of Philadelphia.

At the business meeting to be held May 6, a paper on "Recent Developments in Expanding Machinery" by Luther D. Lovekin will be presented with illustrations; also a paper on "Stereoscopic Vision Applied to Surveying," by Dr. E. F. Northrup.

Railway Signal Association.

Mr. H. S. Balliet, Secretary, Grand Central Station, New York City, announces that the next regular meeting of this Association will be held on Tuesday, May 23, at 10 a.m., in the Grand Union Hotel, 42d street and Park avenue, New York. The following subjects will be offered for discussion: Discipline of Trainmen as Related to Automatic Block Signals, by R. G. Kenly, Trainmaster, Lehigh Valley.

Use of Storage Battery for Track Circuits, by C. C. Anthony, Supervisor of Signals, Pennsylvania R. R.

Use of Gravity Battery for Track Circuits, by William E. Clark, of Clark & Mills Co.

Maintenance of Signals in New York Subway, by J. M. Waldron, Signal Engineer, Interborough Rapid Transit Co.

The discussion of Definitions and Nomenclature will be continued.

PERSONAL.

—Mr. Henry Miller, who has been appointed General Manager of the Wabash, was born at Hannibal, Mo., in 1863. In 1878, he entered railroad service as boiler maker's

apprentice on the Hannibal & St. Joseph, now part of the Burlington system. In 1879 he was made switchman, in 1883 yardmaster, and in 1890 was appointed trainmaster of the St. Louis, Keokuk & Northwestern, now also a Burlington line. He was promoted to be Assistant Superintendent in May, 1892; Superintendent in May, 1902, and in January, 1903, was made General Superintendent of the Missouri district of the Chicago, Burlington & Quincy, which position he leaves to go to the Wabash as General Manager.

—Mr. S. W. Brown, who has just been appointed Superintendent of the Western Division of the Lake Shore & Michigan Southern, with headquarters at Chicago, was born

near Leland, La Salle County, Ill., a small station on the Burlington road, in 1858. At Leland station he learned telegraphy, and for four years from 1872 was night operator at that point. From 1876 to 1878 he was an operator in the general office of the road at

Chicago. In the latter year he was sent to the St. Louis division, where he worked as train despatcher and chief despatcher until 1886, when he left the service to enter commercial life. In 1901 he was appointed trainmaster on the Western division of the Lake Shore & Michigan Southern, and two years later was promoted to be Assistant Superintendent of the division, becoming at the same time also Assistant Superintendent of the Indiana, Illinois & Iowa. This last position he has now resigned.

—Mr. F. J. Kron, who has recently been appointed Superintendent on the Northwest System of the Pennsylvania Lines West, with headquarters at Cambridge, Ohio, has been continuously in the service of the Pennsylvania Company since December 5, 1888, when he began as clerk in the Superintendent's office of the Eastern division at Allegheny, Pa., remaining there in various capacities eleven years. On January 1, 1900, he was appointed Chief Clerk to the Superintendent of the Erie & Ashtabula division, at Newcastle, Pa. Eight months later, he was appointed Assistant Trainmaster, and on October 15, 1902, Trainmaster of the division, which position he held until promoted to his present post.

—Mr. W. S. Kinnear, who has recently been appointed Assistant General Manager of the Michigan Central, was born in May,

1864, and educated at the Kansas State University. In 1883, he entered railroad service as an axeman in an engineering party on the Atchison, Topeka & Santa Fe. Later he served in the location and construction of the Southern Kansas. He continued in engineering work on various railroads in the southwest until 1888, when he went to Southern California. Early in 1889, he went to Chili for the North & South American Construction Company, which company he served as Assistant and Acting Chief Engineer. In 1890, he went to the Michigan Central, then to the Toronto, Hamilton & Buffalo, and after the completion of that road, in 1896, he returned to the Michigan Central as Principal Assistant Engineer, and later, as Assistant Superintendent of the Canada division. In 1902 he was appointed Assistant General Superintendent, and in August of the same year Chief Engineer. This position he still holds, but he has in addition been made Assistant General Manager and, it is understood, will have charge of the building of the Michigan Central tunnel under the Detroit river, at Detroit, which work will probably be begun this year.

—Mr. D. E. Cain, who has just been appointed General Superintendent of the Eastern Grand division of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., was born at Chicago, Ill., in 1862. He began railroading in the general office of the Chicago & North-Western, afterward working at a local freight station at Chicago. Mr. Cain began his work on the Santa Fe in 1881 as cashier at the station at Osage City. He was agent at Osage City and at Leavenworth, and then Chief Clerk to the General Superintendent of Machinery at Topeka. Next he was promoted to be Chief Clerk to the General Manager and then Assistant to the General Manager. In 1902 Mr. Cain was appointed General Superintendent of the Western Grand division, from which he has now been transferred to the Eastern Grand division.

—Mr. F. C. Fox, who succeeds Mr. Cain as General Superintendent of the Western Grand division of the Atchison, Topeka & Santa Fe, was born about 38 years ago. He entered the service of the road as a telegraph operator, going to this road from the Big Four. He was agent and relief agent at various places on the Rio Grande division, and next was made train despatcher at San Marciel, where he was finally promoted to be chief train despatcher and trainmaster. From here he was transferred to be trainmaster of the New Mexico division, with headquarters at Las Vegas. He was made Superintendent of the Western division and has been successively Superintendent of the New Mexico, Rio Grande and Middle divisions.

ELECTIONS AND APPOINTMENTS.

Ann Arbor Railroad.—Cyrus J. Lawrence has resigned from the directorate. Henry W. Asmey, who has been Assistant to the President, has resigned.

Atchison, Topeka & Santa Fe.—J. E. Hurley, who has been General Superintendent of the Eastern Grand division, has been appointed General Manager of the Santa Fe system, succeeding H. U. Mudge, resigned. Mr. Hurley is succeeded as General Superintendent of the Eastern Grand division by D. E. Cain, General Superintendent of the Western Grand division. F. C. Fox, who has been Division Superintendent of the Middle division, succeeds Mr. Cain as General Superintendent of the Western Grand division.

Baltimore & Ohio.—Alexander Kearney, Superintendent of Motive Power at Pittsburg, has resigned. See Norfolk & Western.

Joseph P. Taggart, who has been New England Passenger Agent, has been made Assistant General Passenger Agent at Pittsburg, succeeding E. D. Smith.

Boston & Albany.—H. B. Chapin, having resigned the position of Traffic Manager to engage in other business, the office has been abolished. Howard M. Biscoe has been appointed General Freight Agent, with office in Boston.

Chicago, Burlington & Quincy.—Henry C. Nutt has been appointed General Superintendent of the Missouri district, succeeding Henry Miller. George T. Ross, General Inspector of Station Service, has been appointed General Superintendent of the Iowa district, succeeding Mr. Nutt.

Chicago Great Western.—A. D. Ward, who not long ago resigned his position as Purchasing Agent, has reconsidered his resignation and will remain with the road.

Denver & Rio Grande.—George Geiger, who has been Assistant Superintendent of the Rio Grande Western, has resigned (to become Superintendent of the Cincinnati, Hamilton & Dayton).

Erie.—The duties of Mason R. Strong, Bridge Engineer, have been extended to include buildings, and his title has been changed to Engineer of Bridges and Buildings.

Fort Worth & Rio Grande.—C. W. Strain, Division Passenger Agent of the St. Louis & San Francisco at Wichita, Kan., has been appointed General Passenger Agent of the F. W. & R. G. and the St. Louis, San Francisco & Texas, succeeding W. A. Tuley, resigned.

Great Northern.—R. E. Taft, Resident Engineer at West Superior, Wis., has been appointed Engineer of Construction, with headquarters at St. Paul, Minn. F. W. Walker has been appointed to succeed Mr. Taft. G. A. Casseday has been appointed Bridge Engineer, and Samuel L. Bartlett, Architect, both with headquarters at St. Paul.

Kansas City, Mexico & Orient.—Rolla Wells, Mayor of St. Louis, has been elected a director of this company.

Missouri & Illinois Bridge & Railroad (Alton Bridge).—Joseph Ramsey, Jr., has been elected President; A. J. Davidson, Vice-President; E. D. Taylor, Secretary; F. H. Hamilton, Treasurer, and W. L. Benison, Auditor; Directors, Joseph Ramsey, Jr., C. S. Clark, E. T. Jeffery, R. W. Maguire, C. E. Schaff, W. M. Greene, B. McKeen, E. G. Evans, A. J. Davidson, J. P. Ramsey and B. L. Winchell.

Mobile & Ohio.—See St. Louis, Iron Mountain & Southern.

New York Central & Hudson River.—See Boston & Albany.

Olaf Hoff, Engineer of Structures, has resigned.

Norfolk & Western.—Alexander Kearney, formerly Superintendent of Motive Power of the Baltimore & Ohio, has been appointed Assistant Superintendent of Motive Power, with headquarters at Norfolk. This is a new office which Mr. Kearney is the first to fill.

Panama.—E. S. Benson, late of the Southern Pacific, has been appointed General Auditor of the Isthmian Canal Commission and of the Panama Railroad.

St. Louis, Iron Mountain & Southern.—A. J. Alexander, formerly Superintendent of the Mobile division of the Mobile & Ohio, has been appointed Superintendent of the Illinois division, with headquarters at Chester, Ill. He will have jurisdiction between Bixby and Thebes; Gorham and Bush; Bush and Herrin, and Bush and Zeigler, and supervision of the transportation service between North Junction, Ill., and Illmo, Mo., over Thebes bridge. The office of Assistant Superintendent of the Illinois division is abolished. The jurisdiction of R. K. Smith over the Illinois division is withdrawn. As Superintendent of the Missouri division he will have supervision of the transportation service over the St. L. & S. Ry. between Dexter and Illmo, Mo.

St. Louis, San Francisco & Texas.—See Fort Worth & Rio Grande.

Seaboard Air Line.—B. B. McCrea, who has been Traveling Auditor, has been appointed Auditor of Freight Receipts, succeeding J. H. Burroughs, resigned.

Southern Indiana.—H. P. Radley has been appointed General Freight and Passenger Agent of this company and Superintendent of the Southern Indiana Express Co., succeeding H. H. Roseman, resigned.

Toledo, St. Louis & Western.—Webb C. Ball has been appointed General Time Inspector, with headquarters at Cleveland, Ohio.

Union Pacific.—George J. Gould, President of the Missouri Pacific, has resigned from the executive committee and from the directorate.

Wabash.—Lawrence Greer has resigned as Director and Frederic A. Delano has been elected his successor. Mr. Greer was made Director on April 12 to succeed Cyrus J. Lawrence.

Wabash, Chester & Western.—G. W. Tompkins has been appointed Master Mechanic, with office at Chester, Ill., succeeding E. Danks, resigned.

LOCOMOTIVE BUILDING.

The International & Great Northern has ordered three locomotives.

The Long Island has ordered three locomotives from the Baldwin Works.

The La Crosse & Southeastern has ordered three locomotives from F. M. Hicks & Co., of Chicago.

The Cornwall Railroad has ordered one ten-wheel locomotive to weigh 100,000 lbs. from F. M. Hicks & Co., of Chicago.

F. M. Hicks & Company, of Chicago, have received an order for two locomotives from the Lantry-Sharp Contracting Co.

The Minneapolis, Red Lake & Manitoba has ordered one mogul (2-6-0) locomotive from F. M. Hicks & Co., of Chicago.

The Pittsburg, Cincinnati, Chicago & St. Louis has ordered three locomotives from the Schenectady Works of the American Locomotive Co.

The Chicago & North-Western is reported to have ordered 15 locomotives from the Schenectady Works and 20 locomotives from the Providence Works of the American Locomotive Co.

The Erie has ordered 50 simple consolidation (2-8-0) locomotives from the American Locomotive Co. Specifications for these locomotives are the same as for the 50 consolidations, for which specifications were published in our issue of February 17.

The St. Louis & San Francisco, as reported in our issue of April 21, has ordered 20 simple ten-wheel (4-6-0) locomotives from the American Locomotive Co., and 10 simple six-wheel (0-6-0) switching locomotives from the Baldwin Locomotive Works. Fifteen of the 20 ten-wheel locomotives are to weigh 138,000 lbs. on drivers, with cylinders 21 in. x 28 in., and drivers 62 in. in diameter. The other five ten-wheel locomotives are to weigh 130,000 lbs. on drivers, and have cylinders 21 in. x 26 in. and drivers 69 in. in diameter. All the ten-wheel locomotives are to have a working steam pressure of 200 lbs., a tank capacity of 6,000 gallons, and a coal capacity of 12 tons. The switching locomotives are to weigh 120,000 lbs. on drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 50 in.; working steam pressure, 180 lbs.; tank capacity, 4,500 gallons, and coal capacity, six tons.

The Coal & Coke, as reported in our issue of April 28, has ordered two simple American type (4-4-0) passenger locomotives from the Baldwin Works for June delivery. These locomotives are to weigh 100,000 lbs., with 67,000 lbs. on drivers; cylinders, 18 in. x 24 in.; diameter of drivers, 62 in.; wagon-top boiler, with a working steam pressure of 180 lbs.; 215 iron tubes, 2 in. in diameter and 11 ft. 5 in. long; homogeneous steel firebox, 73⅞ in. x 34⅜ in.; tank capacity, 5,000 gallons, and coal capacity, seven tons. The special equipment includes: Westinghouse-American air-brakes, hammered steel axles with journals 5 in. x 10 in.; Magnesia boiler lagging, Marden brake-beams, Tower couplers, Sessions draft gear, Wabash standard Dressel steel 16-in. headlights, Sellers (class N) improved injectors, Damascus journal bearings, United States metallic piston and valve rod packings, Ashton safety valves, Leach sanding devices, Nathan triple sight-feed lubricators, cast-iron wheel centers, and Safety Car Heating & Lighting Co.'s steam heat equipment.

The Chicago Southern has ordered 20 simple ten-wheel (4-6-0), 12 simple mogul (2-6-0), as reported in our issue of April 21, and eight simple eight-wheel (4-4-0) passenger locomotives from the Rogers Works of the American Locomotive Co., all for 1905 delivery. The ten-wheel locomotives will weigh 145,000 lbs., with 115,000 lbs. on the drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 58 in.; extended wagon top boiler, with a working steam pressure of 180 lbs.; 264 National charcoal iron tubes, 2 in. in diameter and 13½ ft. long; firebox, 84 in. x 66 in.; grate area, 38½ sq. ft.; tank capacity, 5,000 gallons, and coal capacity, 10 tons. The mogul locomotives will weigh 120,000 lbs., with 95,000 lbs. on the drivers; cylinders, 20 in. x 24 in.; diameter of drivers, 52 in.; straight boiler, with a working steam pressure of 160 lbs.; 256 National charcoal iron tubes, 2 in. in diameter and 11 ft. long; firebox, 96½ in. x 33½ in.; grate area, 22 sq. ft.; tank capacity, 4,000 gallons, and coal capacity, eight tons. The passenger locomotives will weigh 125,000 lbs., with 80,000 lbs. on the drivers; cylinders, 18 in. x 26 in.; diameter of drivers, 68 in.; extended wagon top boiler, with a working steam pressure of 180 lbs.; 270 National charcoal iron tubes, 2 in. in diameter and 11 ft. 10 in. long; firebox, 96 in. x 40 in.; grate area, 26½ sq. ft.; tank capacity, 5,000 gallons, and coal capacity, 10 tons. The special equipment for all will include: Westinghouse air-brakes, Midvale steel axles, Cook automatic bell ringers, Keasby & Mattison sectional magnesia boiler lagging, Simplex brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Washburn pilot and Tower tender couplers, U. S. headlights, Nathan injectors, Magnus metal journal bearings, U. S. piston and valve rod packings, Ashton safety valves, Leach sanding devices, Nathan bull's-eye sight-feed lubricators, Pittsburg Spring & Steel Co.'s springs, Crosby steam gages, and Midvale driving and truck wheel tires. Other specialties are: Elvins driving box lubricators for ten-wheel and passenger locomotives, Simplex bolsters, and Symington journal boxes.

The Western Maryland, as reported in our issue of April 14, has ordered 18 simple consolidation (2-8-0) locomotives, five simple ten-wheel (4-6-0) locomotives and three six-wheel switching (0-6-0) locomotives from the Baldwin Locomotive Works for fall delivery. The consolidation locomotives will weigh 190,000 lbs., with 170,000 lbs. on the drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 51 in.; straight-top boiler, with a working steam pressure of 200 lbs.; tubes, 2¼ in. in outside diameter; firebox, 120 in. x 42 in.; grate area, 35 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 10 tons. The ten-wheel locomotives will weigh 165,000 lbs., with 130,000 lbs. on drivers; cylinders, 22 in. x 26 in.; diameter of drivers, 64 in.; wagon-top boiler, with a working steam pressure of 200 lbs.; heating surface approximately 2,600 sq. ft.; tubes, 2¼ in. in outside diameter; firebox, 120 in. x 42 in.; grate area, 35 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, nine tons. The switching locomotives will weigh 140,000 lbs. on drivers; cylinders, 21 in. x 26 in.; diameter of drivers, 51 in.; straight-top boiler, with a working steam pressure of 190 lbs.; tubes, 2¼ in. in outside diameter; firebox, 108 in. x 42 in.; grate area, 31 sq. ft.; tank capacity, 4,000 gallons, and coal capacity, eight tons. The special equipment for all will include: Westinghouse air-brakes, steel axles, hand bell ringers, magnesia boiler lagging, Simplex brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes, Tower (swing head) front couplers and Gould rear couplers, Wabash standard Dressel headlights, Nathan-Simplex injectors, Damascus bronze journal bearings, United States metallic piston and valve rod packings, Consolidated safety valves, Leach double sanding devices, Nathan bull's-eye sight-feed lubricators, Union Spring & Manufacturing Co.'s springs, Latrobe driving wheel and truck wheel tires and cast-iron tender wheel tires for consolidation and switching locomotives, Latrobe driving wheel, truck wheel and tender wheel tires for ten-wheel locomotives, cast-steel wheel centers for consolidation and switching locomotives and steel wheel centers for ten-wheel locomotives.

CAR BUILDING.

The Lehigh Valley has ordered 65 cars.

The Liberty White has ordered four cars.

The Philadelphia & Reading has ordered 25 cars.

The Buffalo, Rochester & Pittsburg has ordered 20 cars.

The Minneapolis & Rainy River has ordered 25 cars.

The Nashville, Chattanooga & St. Louis has ordered 25 cars.

The Baltimore, Chesapeake & Atlantic has ordered 28 cars.

The American Refrigerator Transit Company has ordered 10 cars.

The Pittsburg, Cincinnati, Chicago & St. Louis has ordered 75 cars.

The Harriman Lines are reported to have ordered 25 gasolene motor cars.

The Galveston, Houston & Henderson has ordered one car from the Pullman Co.

The Atchison, Topeka & Santa Fe is reported to have ordered 300 refrigerator cars.

The Pennsylvania is reported to be building 1,000 refrigerator cars at its Altoona shops.

The Higgins Oil & Fuel Company, of Beaumont, Tex., is reported to be building six oil tank cars.

The Louisville & Nashville is reported to be building 200 refrigerator cars at its Decatur shops.

The Louisiana & Arkansas has ordered three coaches from F. M. Hicks & Co., of Chicago.

The Wabash Pittsburg Terminal is reported to have ordered 60 flat cars from F. M. Hicks & Co., of Chicago.

The Grand Rapids & Indiana has ordered 140 cars from the West Detroit Works of the American Car & Foundry Co.

The Bessemer & Lake Erie has ordered one parlor car and one passenger car from F. M. Hicks & Co., of Chicago.

The Stearns Salt & Lumber Company has ordered 50 freight cars of 60,000 lbs. capacity from the American Car & Foundry Co.

The Queen Mahoning Coal Company has ordered 500 steel hopper cars and gondolas from the Standard Steel Car Co., of Butler, Pa.

The New York, New Haven & Hartford is reported to have ordered 300 box cars from the Keith Manufacturing Co., of Sagamore, Mass.

The Atchison, Topeka & Santa Fe is reported to have ordered 300 cars from the Chicago Works of the American Car & Foundry Co.

The Cincinnati, New Orleans & Texas Pacific has ordered three baggage cars from the Jeffersonville Works of the American Car & Foundry Co.

The La Crosse & Southeastern has ordered two passenger cars, two combination cars, one chair car, eight flat cars and one dump car from F. M. Hicks & Co., of Chicago.

The New York, Pennsylvania & Southwestern has ordered eight passenger cars, four combination cars, 100 box cars, 50 gondola cars and 10 flat cars from F. M. Hicks & Co., of Chicago.

The United Zinc & Chemical Company, of Kansas City, Mo., has ordered eight tank cars of 80,000 lbs. capacity and two tank cars of 60,000 lbs. capacity from the Bettendorf Axle Co.

The St. Louis Car Company has received orders for equipment from the Puget Sound Electric Railway, the Pittsburg Railroad (Electric) of Pittsburg, Kan., and the Milwaukee Electric Railway & Light Company.

The Chicago, Rock Island & Pacific has ordered 200 flat cars of 80,000 lbs. capacity from the American Car & Foundry Co. These cars are to have New York air-brakes, Major couplers and Buffalo brake-beams.

The Middletown Car Works, of Middletown, N. Y., are now building 50 box cars of 40,000 lbs. capacity for a railroad in Peru. They have also received orders from a rail-

road in the Argentine Republic for 10 platform cars.

The Continental Car & Equipment Company has recently received a contract from the Government for several hundred automatic dump cars for use in building piers and breakwaters at the United States naval station at Guantanamo, Cuba. These cars are to be 36-in. gage and have a capacity of 4 cu. yds.

F. M. Hicks & Company, of Chicago, report recent orders as follows: American Rice Cereal Co., one private car; Sagua La Grande, Cuba, 40 flat cars; Buffalo Union Furnace Co., 30 ore cars; Patton & Gibson, contractors, 20 flat cars; The Bradley Co., 10 flat cars; St. Joseph Valley Traction Co., one gasolene-electric motor car, and Lantry Sharp Contracting Co., 15 box and four flat cars.

The Colorado & Southern, as reported in our issue of April 21, has ordered eight passenger cars from the Jeffersonville Works of the American Car & Foundry Co. for May delivery. These cars were in stock and were not built to the railroad company's specifications. They are 60 ft. long, with wooden frames and underframes. The special equipment includes: Steel axles, wooden bolsters, National-Hollow brake-beams, cast-iron brake-shoes, Westinghouse high-speed air-brakes, American Car & Foundry Co.'s brasses and draft rigging, Janney couplers, Curtain Supply Co.'s curtain fixtures, Safety heating system, McCord journal boxes, Pintsch gas, Pullman standard paint, steel platforms and canvas roofs.

The Baltimore & Ohio has ordered 10,000 cars. Of these, 1,000 steel gondolas and 1,000 steel hopper cars are from the Pressed Steel Car Co., which also furnishes 2,000 steel underframes for the box cars ordered from the Western Steel Car & Foundry Co. and the South Baltimore Steel Car & Foundry Co.; 2,000 all-steel hopper cars are ordered from the American Car & Foundry Co., 2,000 all-steel gondolas from the Cambria Steel Co., 1,500 composite gondola cars from the Standard Steel Car Co., 1,000 steel underframe box cars from the Western Steel Car & Foundry Co. and 1,000 steel underframe box cars from the South Baltimore Steel Car & Foundry Co. In addition, 250 refrigerator cars have been ordered from the American Car & Foundry Co. and 250 ballast cars from the Rodger Ballast Car Co.

The Nashville, Chattanooga & St. Louis, as reported in our issue of April 21, is building 250 box cars of 60,000 lbs. capacity at its Nashville shops for June delivery. These cars are to weigh 34,000 lbs., and measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurement, and 36 ft. 10¼ in. long, 9 ft. 1⅝ in. wide and 13 ft. 4½ in. high over all, with wooden frames and underframes. The special equipment will include: Iron axles, Commonwealth Steel Co.'s cast-steel bolsters, Simplex brake-beams, Nashville, Chattanooga & St. Louis standard cast-iron brake-shoes and standard brasses, dust guards and journal boxes, Westinghouse air-brakes, Tower couplers, National door fastenings, Moore doors, Thornburgh draft rigging, Winslow roofs, Railway Steel-Spring Co.'s springs, arch-bar trucks and Louisville Car Wheel Co.'s cast-iron wheels.

BRIDGE BUILDING.

Albany, N. Y.—The lowest bid for building the superstructure of the hoist bridge over the Oswego canal at East Willow street opened by State Superintendent of Public Works N. V. V. Fanchot, was that of the Rochester Bridge & Construction Co., $23,259.

Baltimore, Md.—The Baltimore & Ohio is replacing many old bridges with new structures as follows: On the Philadelphia division, about 14 bridges; on the Pittsburg division, between Allegheny and Newcastle Junction, four over Pine creek, for which a contract has been let to the Mount Vernon Bridge Co. for the steel work. A bridge will be built at Ellwood City, which is to carry two tracks, and will be 180 ft. long with approaches of 560 ft.; with the rails 130 ft. above the water; at Port Perry, the present bridge carrying four tracks will be widened for two additional tracks, for which a contract has been given to the McClintic-Marshall Construction Co. for the steel work, and which will be built by the Youngstown Construction Co.

Cleveland, Ohio.—Bids are wanted May 10 by the Board of Commissioners of Cuyahoga County for building two stone bridges in Bedford and Warrensville townships. Julius E. Dorn is Clerk.

Des Moines, Iowa.—The Chicago Great Western, it is reported, has decided to spend about $300,000 for building concrete bridges between Des Moines and Kansas City during the coming summer.

Easton, Pa.—A contract has been given to T. M. Lesher, of this place, to build a bridge over the Lehigh river to Island Park by the Easton Transit Co.

Harrisburg, Pa.—A contract is reported let to Enos L. Seeds, of Philadelphia, for building the connecting bridge between the Pennsylvania and the Philadelphia & Reading stations at this place, to consist of a structure 300 ft. long, with a covered bridge 75 ft. long, over the tracks between the two stations.

Kansas City, Kan.—The Chicago, Rock Island & Pacific, it is reported, will at once put up a two-span steel bridge, each span 300 ft. long, over the Kaw river, to replace the structure destroyed by floods in 1903.

Kingstree, S. C.—Bids are wanted May 16 by the Boards of County Commissioners of Georgetown and Williamsburg Counties for building a steel bridge 180 ft. long on brick foundations. J. B. Johnson is County Supervisor, Georgetown, S. C.

Long Pine, Neb.—A contract is reported let to Robert Milone, of Lincoln, for building a steel bridge 600 ft. long and 130 ft. high over Pine creek canon, west of this place.

Palestine, Tex.—A contract has been given by the International & Great Northern to the Missouri Valley Bridge Co., of Leavenworth, Kan., at about $600,000 to replace many of its bridges with heavy steel structures between Palestine and San Antonio, on which work is to be commenced at once.

St. Thomas, Ont.—Bids are being asked by James A. Bell, City Engineer, for building a steel bridge at St. George street.

Seaforth, Ont.—Plans are being made to build a steel bridge 110 ft. long on concrete abutments over the river near Bodmin.

Stratford, Ont.—A committee has been appointed to prepare plans for building a steel bridge over the Thames river on the boundary of Fullerton, Dowie and Blanchard townships.

Other Structures.

Beatrice, Neb.—The Chicago, Burlington & Quincy, it is said, has decided to build a new stone passenger station, for which $70,000 has been appropriated.

Dennison, Ohio.—The Pennsylvania, it is said, will spend about $325,000 on shop improvements at this place, to include a new 34-stall roundhouse.

Durand, Mich.—The Grand Trunk, local reports state, will at once replace its passenger station, recently destroyed by fire, with a larger building.

Lorain, Ohio.—The Baltimore & Ohio, it is said, will build a roundhouse to cost $60,000.

Muncie, Ind.—The Indiana Union Traction Co. has plans ready for putting up a new three-story brick combined passenger and freight station at Charles and Howard streets, to cost about $50,000.

Sedalia, Mo.—The Missouri, Kansas & Texas shops at this place, it is said, will be enlarged to double their capacity. Work is to be started at once, and new machinery will be added about the first of October.

Somerset, Ky.—A contract is reported let to M. Casey, of Birmingham, Ala., by the Cincinnati, New Orleans & Texas Pacific for putting up a roundhouse and other buildings at this place.

Terre Haute, Ind.—Plans, it is reported, have been completed by the Southern Indiana for putting up brick shops here.

Tulsa, Ind. T.—The St. Louis & San Francisco is planning to put up a new station to cost $20,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

American Mexican Pacific.—A contract is said to have been let by this company, which was recently organized, for building the first 250 miles of its proposed road in Mexico. This company is planning to build over 2,000 miles of road in West Mexico and Arizona, the first division to be from Naco, Ariz., to a port on the gulf of California.

Arkansas, Louisiana & Gulf.—A charter has been granted in Arkansas to a company under this name with a capital of $1,000,000 to build a road from Star City to Portland, Ark., 60 miles, through the counties of Lincoln, Drew and Ashley. E. A. Sunderlin and J. H. Parker, of Colorado Springs, Colo., are interested; also J. G. Williams, J. D. Welsh, of Monticello, and H. R. Lucas, of Star City.

Atchison, Topeka & Santa Fe.—The contracts for double tracking various sections of this road in Illinois, Missouri and Kansas have recently been let. Among the contractors are the Pettibone-Gentry Co., of Chicago; Haines & Co., of Topeka, Kan.; Cameron, McManus & Joyce, of Keokuk, Iowa; Lantry-Sharpe Contracting Co., of Kansas City, Mo.; Dolman & Sons, of Topeka, and Likes & Harfield, of Wichita, Kan.

Bids are being asked by this company for a change of line between Melvern and Olivet, Kan., and from Canadian to Glazier, on the Pecos Valley line in Texas. Also for second track work between Peabody and Braddock, Kan., between Walton and Lehman, Kan., between Jansen and Morley, Colo., and between Lynn and Hillside, N. Mex. Also for grade reduction between Florence, Kan., and Newkirk, Okla., and between Newton and Dodge City, Kan., and for a raise of grade and levee at the Canadian river crossing near Purcell, Ind. T.

Surveys, it is reported, are being made by this company for a branch from Woodward, Okla. T., westward through Beaver City to a connection with the Rock Island at Guymon, Okla. T.

Buffalo & Susquehanna.—An extension, it is said, will be built by this company from Juneau, south of Dubois, Pa., to a point three miles beyond Plumfield, a distance of 20 miles, where the company recently acquired large tracts of coal lands.

Canadian Pacific.—The MacGregor branch of this road, it is said, will be extended from Brookdale to Varcoe, about 20 miles, during the present year.

Chesapeake & Ohio.—On the double tracking of this road from Dayton, Ky., to Silver Grove, an officer states that construction work will be started at once. A contract has been let to the Langhorne Contracting Co., of Greenwood, Va. No grading or track laying has yet been done. The work is not difficult and does not include any bridges or tunnels.

Chicago Electric Roads.—Bids are asked for by July 1 by the Controller of the city of Chicago for the construction of a system of municipal street railways in the city of Chicago.

Chickasaw & Jackson.—Application for a new charter is being made by this company to build a line in Wayne County, the previous one having expired.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—This company is asking bids May 12 for grade reduction and masonry construction work on its Cairo division between Allenville and Harrisburg, which calls for the excavation of 1,625,000 cu. yds. of earth and the constructing of 17,000 cu. yds. of masonry; between Westville and Allendale, the excavation of 1,400,000 cu. yds. of earth and constructing of 200,000 cu. yds. of masonry work, and at St. Francisville, Ill., the excavation of 200,000 cu. yds. of earth and constructing of 10,000 cu. yds. of masonry.

COLUMBUS & LAKE MICHIGAN.—The proposed line of this road is from Lima, Ohio, to West Mansfield. An officer writes that it will be operated by steam, and the prospects of building are certain. No track has yet been laid, as the route has not been definitely fixed. The work will be done mostly by the company's forces and includes the excavation of about 15,000 cu. yds. of earth per mile. There will be two girder bridges of 60 ft. and 80 ft. and some culverts. General George A. Garretson, of Cleveland, is President, and C. T. Hobart, Lima, Ohio, General Manager.

CORRY, FINDLEY LAKE & NORTHEASTERN TRACTION.—Application has been made to the Pennsylvania Legislature for a charter to build a line from Corry, about 30 miles long, with a branch to Lake Columbus. The project is being backed by Boston capitalists.

CUMBERLAND RIVER & NASHVILLE.—At a recent meeting of the directors, a contract was let to the Cincinnati Construction Co. to build a line from Burnside, Ky., to Monticello, 25 miles.

GAINESVILLE, DAHLONEGA & NORTHERN.—The charter which was granted this company some time ago having lapsed, a new one has been granted. The company will have a capital of $500,000 and proposes to build a road to be operated by electricity or steam from Gainesville, in Hall County, Georgia, to Dahlonega, in Lumpkin County, Ga., 25 miles, with a branch to the Chestatee pyrites mines. The incorporators are: A. J. Warner, W. A. Carlisle, W. H. Slack, F. P. Catchings and H. H. Dean, of Gainesville, and J. F. Moore, W. A. Charters, H. D. Gurley and others, of Dahlonega.

GREAT NORTHERN.—A contract is reported let to Siems & Shields, of St. Paul, for building a branch from a point on the Great Northern's Republic line to Princeton, B. C., 86 miles.

A contract is reported let to Peter Sims, of St. Paul, for building an extension from Sioux City, Iowa, to Ashland, Neb., at which point connection will be made with the Chicago, Burlington & Quincy.

GREAT SOUTHERN.—This company, which was recently granted a charter in Washington, proposes to at once begin construction on 45 miles of road from The Dalles, which will eventually be extended into California. An extension as far as Bend, Ore., will be made. Grading has been finished for 30 miles, and rails are ready to be laid. Work is under way at The Dalles for the terminals. The proposed route from The Dalles runs west of the Deschutes river to Durfur. The maximum grade will be 1.5 per cent.

INTERBOROUGH (NEW YORK CITY).—The subway loop at Battery Park, Manhattan, has been completed and track laying will be begun at once. It is expected that subway trains will be run to the Battery in about two months.

JOHNSON CITY, BAKERSVILLE & SOUTHERN.—This company proposes to build a road from Johnson City, Tenn., to Bakersville, N. C., 40 miles, 22 miles of which will be in Tennessee, via Unicoi and Limestone Cove, Tenn., and Magnetic City and Big Rock Creek, N. C. About 8½ miles of line was built some four years ago from Unicoi to Davisville, Tenn., and surveys have been made from that place as far as Johnson City, 18½ miles. The balance of the road is now under survey and eight miles will be built at once. C. B. Allen, of Johnson City, is Vice-President.

LOUISIANA & PINE BLUFF.—An officer writes that this company, which is building a steam road 20 miles long, on which track has already been laid for three miles, has given a contract to S. R. Neal, of Huttig, Ore., for the balance of the road. The road will have a maximum grade of .5 per cent.

OCCIDENTAL CONSTRUCTION COMPANY.—Under this name, a company, in which Lewis Warfield and Harold Miller, of New York, are interested, has made application to the Mexican Government for permission to build a line, for which surveys have been completed, between Guaymas and Guadalajara. Active work will be commenced at Culiacan and the line between Mazatlan and Guaymas will be built first. This is the same company that has been promoting the line from Topia to the port of Altata, which project has been abandoned.

PENNSYLVANIA.—A contract has been given by this company to the United Engineering & Construction Co. for building that portion of the New York City tunnel under Thirty-second and Thirty-third streets from Seventh avenue to First avenue, New York. From the terminal eastward these tunnels will descend at a .5 per cent. grade to Fifth avenue; thence a 1½ per cent. grade carries it to the lowest point under the East river. At Fifth avenue, the tracks will be 50 ft., and at First avenue 70 ft. below the surface.

SOUTHERN.—A contract to double-track this road between Atlanta and Austell, Ga., 20 miles, is reported let to W. J. Oliver, of Knoxville, Tenn. The work will be heavy, as the road passes through a hilly section. The double tracking is made necessary by increased traffic. This section will be used both by the Atlanta & Birmingham division trains and the Atlanta & Austell.

SOUTHERN PACIFIC.—Surveys are reported being made by this company to permanently locate an extension to be built from Beeville, Texas, to the Mexican border at Laredo.

TEXAS ROADS.—Contracts, it is reported, have been let by a company to build an interurban line from Dublin at the junction of the Texas & Pacific and Texas Central roads, to Hamilton, 35 miles, in a southerly direction through a territory at present without a railroad. It is also stated that the road will be extended north from Dublin 30 miles to a junction with the Texas & Pacific at the Thurber mines or into Gorden, on the main line of the Texas & Pacific.

TIDEWATER RAILROAD.—The property of the Norfolk-Hampton Roads Shipbuilding & Drydock Co., recently sold at auction, will be turned over to this company as a site on which to build its terminals.

WESTERN PACIFIC.—Work on the construction of this road will be begun at once, the contract having been given to Walston H. Brown & Bros., of New York. The proposed route is from Salt Lake City, Utah, to Oakland, Cal., on San Francisco bay, 930 miles. The maximum grade through the Sierra Nevada Mountains is expected to be only about 1 per cent.

WHITE SULPHUR SPRINGS.—A charter has been granted this company in Arkansas to build a road from Van Buren to Uniontown, Ark., 15 miles. The officers include: R. P. Allen, Van Buren, President; James H. Van Brunt, St. Joseph, Mo., Vice-President; J. L. Rea, Van Buren, Secretary, and B. E. Powers, Van Buren, Treasurer.

WISCONSIN CENTRAL.—Rights of way are reported secured and grading is in progress on the line of this company between Owen and Superior.

WASHINGTON, IDAHO & MONTANA.—A company is being organized in Idaho, of which F. B. Thatcher, of Winona, Minn., is to be President, with a capital of $1,000,000, to build a road from some point in the white pine timber belt, in the clear water region, to points in Washington, and ultimately to Puget Sound. The Weyerhaeuser timber syndicate is said to be interested in the company.

RAILROAD CORPORATION NEWS.

ATLANTIC COAST LINE.—This company has given notice that holders of Wilmington & Weldon general first-mortgage 4 per cent. bonds of 1935 and Yadkin division first-mortgage 4 per cent. bonds of 1943; of the first-mortgage 4 per cent. bonds of 1947 of the Wilmington & Newbern, the general-mortgage 4 per cent. bonds of 1948 of the Atlantic Coast Line of South Carolina, the first-mortgage 4 per cent. bonds of 1938 of the Brunswick & Western and the 4 per cent. bonds of 1918 of the Silver Springs, Ocala & Gulf may, until July 15, exchange these bonds at par at the United States Trust Co., New York, for the first consolidated-mortgage 4 per cent. bonds of 1952 of the Atlantic Coast Line Railroad, the difference of interest to be adjusted at the time of the exchange.

CANADA ATLANTIC (GRAND TRUNK).—On May 16, a meeting of the stockholders will be held to vote on issuing bonds or other mortgage securities to an amount not exceeding $16,000,000.

CHESAPEAKE & OHIO.—This company's statement for the month of March shows gross earnings of $1,843,344 in 1905, against $1,657,826 in 1904, and net earnings of $658,962 in 1905, against $590,413 in 1904. For the nine months ended March 31, the operating ratio decreased from 66.2 per cent. in 1904 to 64 per cent. in 1905, and net earnings increased from $4,834,345 in 1904 to $5,546,317 in 1905.

CHICAGO & NORTH-WESTERN.—Both the preferred and common stockholders of this company have been offered the privilege of subscribing to new common stock at par in the proportion of 15 per cent. of their present holdings. This latter stock increases the amount of stock issued by $10,609,677 and will make the total amount of common stock outstanding $58,945,739. The amount of preferred stock now outstanding is $22,395,120. The purposes to which the proceeds of the new stock will be devoted are stated in a resolution of the directors to be for "extending the present property, for improvements and equipment and other lawful purposes."

CHICAGO, ROCK ISLAND & PACIFIC.—This company's statement for the eight months ending February, 1905, shows gross earnings of $28,329,110 and net earnings of $9,248,671. To this figure is to be added other income of $819,522, making the total income $10,068,193. Against this were charged: Taxes, $1,075,905; interest and rentals, $5,437,786, and betterments, $61,304, a total of $6,574,994. This leaves a balance of $3,493,198, from which dividends amounting to $3,179,972 were paid, leaving a surplus for the eight months of $313,226.

CINCINNATI INTER-TERMINAL.—This company, whose road will connect the Chesapeake & Ohio bridge at Cincinnati, and the Cincinnati, Hamilton & Dayton terminals, has recently reduced its capital stock from $410,000 to $10,000 and immediately increased it to $1,010,000, of which $10,000 is common stock issued for the purpose of control and $1,000,000 4 per cent. first preferred stock guaranteed by rentals to be paid by the Chesapeake & Ohio and the Louisville & Nashville. The common stock is owned by the Covington & Cincinnati Elevated Railroad & Transfer & Bridge Co., which owns the Chesapeake & Ohio bridge at Cincinnati and whose $1,500,000 stock is owned by the Chesapeake & Ohio. First preferred stock of the Cincinnati Inter-Terminal Railroad is to be issued for construction. George W. Stevens, President of the Chesapeake & Ohio, is President of the company.

COLORADO & SOUTHERN.—Governor McDonald, of Colorado, has refused to sign the bill authorizing this company's proposed extension to Galveston.

EASTERN NEW YORK (ELECTRIC).—This company, the successor to the Ballston Ter-

minal Railroad, an electric road running from Ballston, N. Y., to Middle Grove, 15 miles, has recently made a mortgage to secure $1,750,000 5 per cent. gold bonds of 1935. There is outstanding $500,000 of the authorized $1,750,000 capital stock, all common stock.

Fort Wayne, Van Wert & Lima Traction.—This company has given a first mortgage of $2,000,000 to the Fidelity Trust Co., of Philadelphia, the proceeds from which will be used for extensions east of Lima, Ohio.

Halifax & Southwestern.—The Nova Scotia Legislature has passed a bill permitting the Halifax & Southwestern to acquire the Halifax & Yarmouth and the Middleton & Victoria Beach railroads, and authorizing the borrowing of $1,075,000. This is at the rate of $13,500 a mile on the 50 miles already built of the Yarmouth & Halifax and $10,000 a mile on the 40 miles of the Middleton & Victoria Beach. The loan is to be made in 3½ per cent. 40-year bonds. All of these roads are controlled by the Mackenzie & Mann interests. A connection 85 miles long from Liverpool southwest to Barrington Passage is still to be built between the two roads which are consolidated by this bill.

Illinois Central.—This company reports an increase of $194,000 in net earnings for the month of March, and for the nine months ending March 31, an increase of $2,343,716 in gross earnings, a decrease of $226,003 in operating expenses and an increase in net earnings of $2,569,719.

Interborough Rapid Transit.—About $360,000 has been turned over to the City of New York by this company as the city's percentage of the income for the first five months from the operation of part of the subway. Altogether there is due the city on this account about $530,000, but from this amount has been deducted the interest on the company's deposit of $1,000,000 in addition to the $5,000,000 in securities which the state has held as a guarantee. The Comptroller of New York City estimates that the actual payments to the city when the entire line is in operation will amount to from $1,500,000 to $2,000,000 a year.

Minneapolis, Red Lake & Manitoba.—This company, which is building a line from Bemidji, Minn., to Red Lake, 35 miles, has given a mortgage to secure $440,000 in 20-year 5 per cent. bonds.

New York, New Haven & Hartford.—The Attorney-General of the state of Massachusetts has given an opinion to the Massachusetts Legislature that the acquisition of the stock of the Springfield Street Railway Co. or of any Massachusetts street railway corporation by the New York, New Haven & Hartford is illegal and that the action of the courts may be invoked either to nullify or restrain the transaction or to forfeit the charter in Massachusetts of the New Haven company.

It is reported that an offer of $150 a share has been made by the New Haven road for a majority of the capital stock of the Suffield (Conn.) Street Railway, and an offer of $125 per share for control of the Suffield Water Company, payment in either case to be made in 4 per cent. bonds of the Consolidated Railway Company of Connecticut. The stockholders are given until May 10 to accept the proposition. The Suffield Railway Company operates about five miles of road connecting with the Springfield Street Railway, recently bought by the New Haven Co. It has been controlled by the Springfield Street Railway. It has $300,000 capital stock and at present pays 4 per cent. dividends.

Northern Pacific.—The $155,000,000 capital stock of this company has again been listed on the New York Stock Exchange. The general balance sheet issued by the company as of February 28 shows capital assets of $432,997,406 and current assets of $52,444,744, a total of $485,442,150. The estimated value of the Northern Pacific's half interest in the 1,076,116 shares of Chicago, Burlington & Quincy capital stock owned by the Great Northern and Northern Pacific jointly is placed at $109,112,909. A statement of earnings for the eight months ended February 28 shows gross earnings of $33,771,946 in 1905, as against $31,939,558 in 1904; net earnings of $17,492,424 in 1905, against $16,466,292 in 1904, and net income of the main system of $17,671,864 in 1905, against $15,431,174 in 1904. The surplus was $4,181,001 in 1905, against $2,193,231 in 1904.

Oregon Short Line.—Application has been made by this company to the New York Stock Exchange to list $45,000,000 refunding bonds issued to retire the participating 4 per cent. bonds called on Feb. 1, 1905. At present these bonds are secured by Northern Securities stock, but the mortgage allows the substitution of other collateral.

Pennsylvania.—Bioren & Co., of Philadelphia, are offering at 100½, $1,500,000 of the new convertible 3½ per cent. gold bonds of 1916. These bonds, as announced at the time the issue was decided upon, are convertible into stock at 150 at any time after December 1 unless previously called for redemption. The option to redeem begins Dec. 1, 1910.

This company for the month of March shows on lines directly operated an increase in net earnings of $552,900, and for the three months ending March 31, an increase of $1,087,500. On the lines directly operated west of Pittsburg and Erie, net earnings increased $91,600 in the month of March and $532,400 in the three months ending March 31.

Philadelphia Rapid Transit.—The stockholders of this company have authorized the guarantee of the new $10,000,000 bond issue of the Market Street Elevated Passenger Railway.

Reading Company.—The statement of this company and its controlled properties for the nine months ending March 31, 1905, shows a surplus over fixed charges of $7,618,000, or a gain of $2,490,000 over the corresponding period in 1904. The surplus for the year ending June 30, 1904, was $10,204,000, which includes $2,447,000 spent for improvement of roadbed and collieries, not directly chargeable to income until after dividends have been subtracted. After payment of 4 per cent. on the first preferred stock and 3½ per cent. on the second preferred, there was left a surplus earned on the common stock of $7,614,000, or about 10½ per cent. The net surplus for the past nine months of $7,618,000 is therefore only slightly less than that shown for the entire fiscal year of 1903-04.

Rochester Railway & Light Company.—This company has bought control of the Rochester & Suburban Railroad, which operates a trolley line from Rochester to Irondequoit Bay and controls the Rochester & Summerville line to Lake Ontario, and valuable lands, buildings and franchises. By this purchase, the Rochester Railway & Light Co. secures control of all the trolley lines in Rochester and in Monroe County. The purchase price is reported to have been $675,000. Three-fourths of the stock of the Rochester & Suburban Co. has already been deposited in support of the sale, which was made through E. W. Clark & Co., bankers, who agreed to purchase all the bonds and obligations of the Rochester & Suburban at par, and not less than two-thirds of the capital stock of the company at $35 a share for the preferred and $1 a share for the common stock. The amount of obligations outstanding, outside of the capital stock, amounted to about $552,000. Deducting this amount, the price paid for the common stock was $1 a share for the 700 shares of common stock and $35 a share for the preferred stock.

St. Louis & San Francisco.—This company has made an offer to holders of Chicago & Eastern Illinois common stock trust certificates to issue new certificates of $1,000 each for each four of the present certificates, the new certificates to bear 4 per cent. interest and to be due July 1, 1922. This change in securities is to go into effect on or before July 20 provided a majority assents to it before May 10. It is merely a change in form of securities, as it causes no change of interest.

Schuylkill Railway (Electric).—This is a new company which has purchased the property of the Schuylkill Traction Co., of Girardville, Pa., and the Lakeside Railway Co. subject to underlying bonds. In order to provide for these, $755,000 of the bonds of the new company have been reserved. The Lakeside Railway is bought subject to a ground rent equal to 5 per cent. of its gross earnings, to be paid to it under the terms of its lease to the Schuylkill Traction Co. The new company has made a mortgage to secure $1,450,000 bonds and has agreed to at once spend about $100,000 for betterments.

Southern Pacific.—This company has given notice to holders of its two-five-year 4½ per cent. gold bonds dated Dec. 1, 1900, that it will redeem them at par and interest on June 1, on which date interest will cease. At the same time, announcement is made of a new issue of $30,000,000 two-five-year 4 per cent. gold bonds dated June 1 and redeemable at the option of the company at par and interest on June 1, 1907, or on any interest date thereafter. Holders of the two-five-year bonds that have been called for redemption have the privilege of exchanging them for the new bonds at par by paying $42.50 in cash for each $1,000 of the bonds called for redemption with the coupons maturing June 1 and December 1 attached.

Union Pacific.—The March statement of this company shows an increase of $751,000 in gross earnings and $454,000 in net earnings for the month. For the nine months ended March 31, 1905, gross earnings increased $2,655,000, and net earnings $1,793,000.

Wabash.—The $7,000,000 notes recently sold to William A. Read & Co. and George P. Butler & Bro. were 4½ per cent. five-year gold notes of 1910 of an authorized issue of $10,000,000. At the option of the company, they are redeemable at par and interest on any interest day after 60 days' notice.

Western Pacific.—The $50,000,000 30-year first-mortgage bonds recently sold (at 90) to a syndicate headed by William A. Read & Co., William Salomon & Co. and Blair & Co. were 5 per cent. bonds subject to call at 105 and secured by a first mortgage on the projected line from a point on the Rio Grande Western near Salt Lake City (probably Thistle Junction) to Oakland, opposite San Francisco, with branches, about 930 miles. They are also to be secured by the pledge of contracts with the Denver & Rio Grande and the Rio Grande Western by which these roads jointly and severally agree to meet any deficiency in the earnings of the Western Pacific to meet the interest on the bonds. This is reported to be an absolute guarantee. A majority of the stock of the Western Pacific is to be owned by these roads, and E. T. Jeffery, President of the Denver & Rio Grande, will be president of the new company. The Rio Grande Western further guarantees that if the proceeds of the $50,000,000 bonds are not sufficient to build and equip the road, it will buy new securities of the Western Pacific to the amount necessary to finish the road.

Wheeling & Lake Erie.—This company is reported to have sold at 88½ $10,000,000 of its proposed issue of $50,000,000 4 per cent. 50-year gold bonds. The mortgage covering these bonds is to be voted on by the shareholders on May 20. Under the mortgage, $15,000,000 bonds are to be issued to retire underlying bonds, and $25,000,000 will be reserved for future additions and improvements, in addition to the $10,000,000 already sold, which were to provide for double tracking and other improvements.